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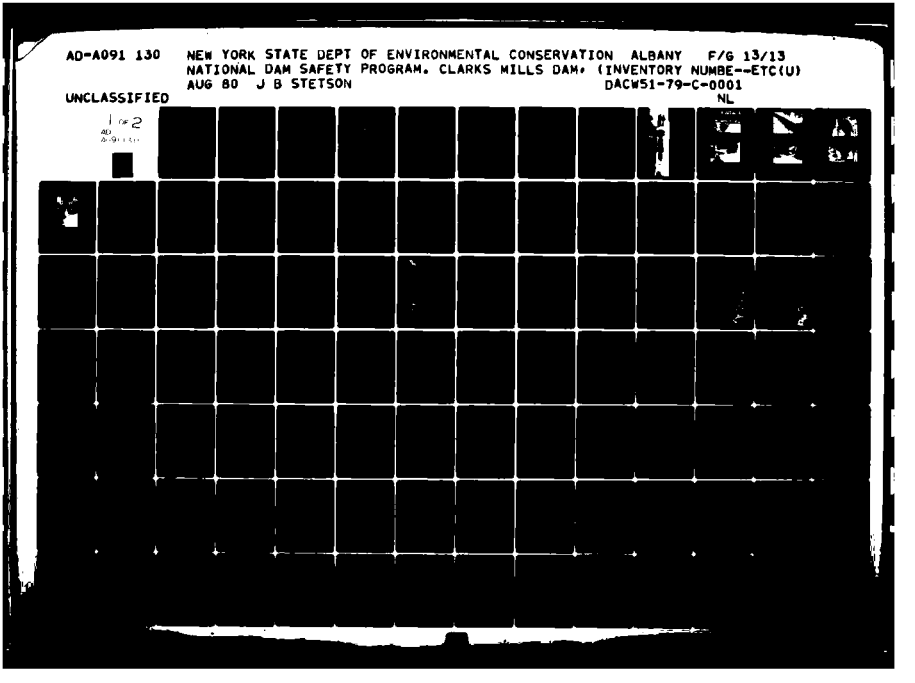

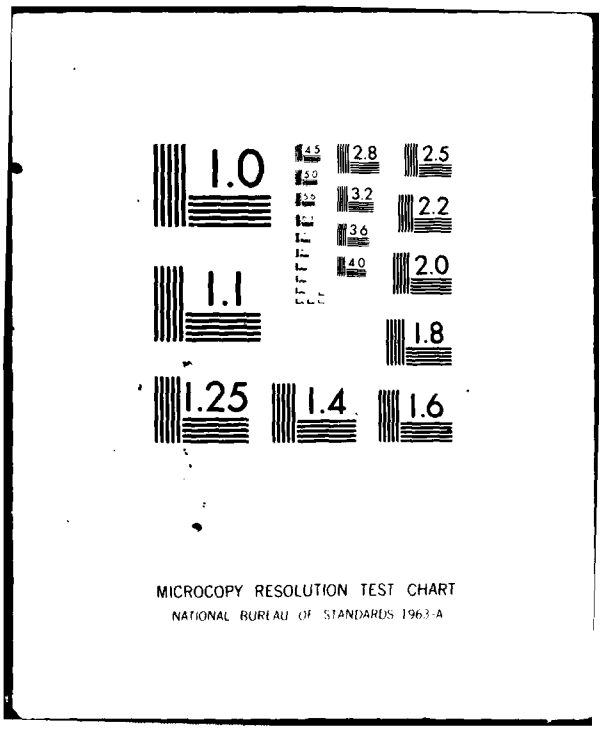
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1. REPORT NUMBER	2. GOVT ACCESSION NO. AD-A091130
3. RECIPIENT'S CATALOG NUMBER	
4. TITLE (and Subtitle) Phase I Inspection Report Clarks Mills Dam Upper Hudson River Basin, Washington County, NY Inventory No. 120	5. TYPE OF REPORT & PERIOD COVERED Phase I Inspection Report National Dam Safety Program
	6. PERFORMING ORG. REPORT NUMBER
7. AUTHOR(s) John B. Stetson	8. CONTRACT OR GRANT NUMBER(s) DACW-51-79-C-0001
9. PERFORMING ORGANIZATION NAME AND ADDRESS Stetson-Dale Engineering Company Bankers Trust Building Utica, NY 13501	10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS
11. CONTROLLING OFFICE NAME AND ADDRESS New York State Department of Environmental Conservation 50 Wolf Road Albany, NY 12233	12. REPORT DATE 28 August 1980
	13. NUMBER OF PAGES
14. MONITORING AGENCY NAME & ADDRESS (if different from Controlling Office) Department of the Army 26 Federal Plaza New York District, CofE New York, NY 10287	15. SECURITY CLASS. (of this report) UNCLASSIFIED
	15a. DECLASSIFICATION/DOWNGRADING SCHEDULE

LEVEL II

16. DISTRIBUTION STATEMENT (of this Report)

Approved for public release; Distribution unlimited.

17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)

18. SUPPLEMENTARY NOTES

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19. KEY WORDS (Continue on reverse side if necessary and identify by block number)

Dam Safety
National Dam Safety Program
Visual Inspection
Hydrology, Structural Stability
Clarks Mills Dam
Washington County
Batten Kill

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

This report provides information and analysis on the physical condition of the dam as of the report date. Information and analysis are based on visual inspection of the dam by the performing organization.

The examination of documents and visual inspection of the dam and appurtenant structures did not reveal conditions which constitute an immediate hazard to human life or property. The dam, however, has a number of problem areas which should be investigated, evaluated, and remedied. →

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The structural stability analysis indicates the south portion (left side looking downstream) of the structure demonstrates unsatisfactory stability under loading conditions which could occur during winter operation (including ice loading) and during the Probable Maximum Flood (PMF) and 1/2 PMF conditions. Lack of dimensions and design data for the north portion of the spillway did not allow the structural analysis of this section of the structure to be performed. A detailed investigation of the structural components of the northerly spillway section should be commenced within 6 months and followed with a structural investigation of the entire dam section to determine the measures necessary to increase the structural stability of the installation. The walkway through the interior of the north portion of the dam should be repaired to allow inspections to the interior of the dam. The remedial work necessary to increase the structural stability of the facility should be completed within two years.

Hydrologic/hydraulic analysis performed in accordance with the Corps of Engineers Recommended Guidelines for Safety Inspection of Dams establishes the spillway capacity as 16% of the Probable Maximum Flood (PMF). The dam will be overtopped by 15.66 feet and 7.47 feet by the PMF and 1/2 PMF respectively. Since failure of the southerly section of the dam under the 1/2 PMF will not significantly increase the downstream hazard to loss of life from that which would exist just prior to a dam failure during this 1/2 PMF event, the spillway is assessed as inadequate.

Leakage is occuring through the concrete into the core of the Northerly, Ambursen-Type-Section. Extensive deterioration has taken place at the north abutment and at the pier separating the two sections.

The following remedial measures should be undertaken within one year:

1) Eliminate leakage into the interior core of the dam and repair deteriorated concrete on the north abutment and at the pier separating the two sections of the dam.

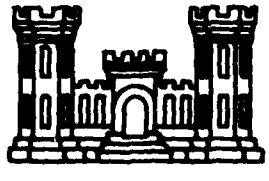
2) A formalized inspection program should be initiated to develop data on conditions and maintenance operations at the facility.

3) A flood warning and emergency evacuation plan should be developed and implemented to alert the public in the event conditions occur which could result in failure of the dam.

UPPER HUDSON RIVER BASIN

CLARKS MILLS DAM
WASHINGTON COUNTY
NEW YORK
INVENTORY Nº NY 120

PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM



NEW YORK DISTRICT CORPS OF ENGINEERS

JULY 1980

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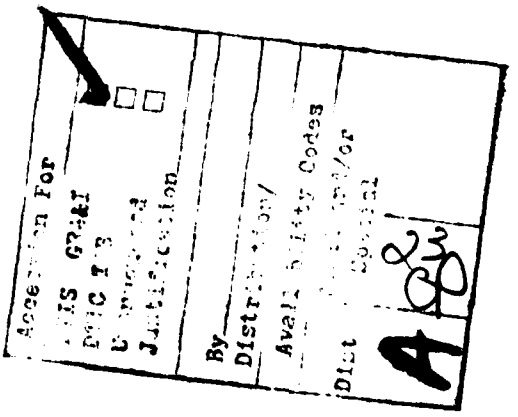
PREFACE

This report is prepared under guidance contained in the Recommended Guidelines for Safety Inspection of Dams, for Phase I Investigations. Copies of these guidelines may be obtained from the Office of Chief of Engineers, Washington, D.C. 20314. The purpose of a Phase I Investigation is to identify expeditiously those dams which may pose hazards to human life or property. The assessment of the general condition of the dam is based upon available data and visual inspections. Detailed investigation, and analyses involving topographic mapping, subsurface investigations, testing, and detailed computational evaluations are beyond the scope of a Phase I Investigation; however, the investigation is intended to identify any need for such studies.

In reviewing this report, it should be realized that the reported condition of the dam is based on observations of field conditions at the time of inspection along with data available to the inspection team. In cases where the reservoir was lowered or drained prior to inspection, such action, while improving the stability and safety of the dam, removes the normal load on the structure and may obscure certain conditions which might otherwise be detectable if inspected under the normal operating environment of the structure.

It is important to note that the condition of a dam depends on numerous and constantly changing internal and external conditions, and is evolutionary in nature. It would be incorrect to assume that the present condition of the dam will continue to represent the condition of the dam at some point in the future. Only through frequent inspections can unsafe conditions be detected and only through continued care and maintenance can these conditions be prevented or corrected.

Phase I inspections are not intended to provide detailed hydrologic and hydraulic analyses. In accordance with the established Guidelines, the Spillway Test flood is based on the estimated "Probable Maximum Flood" for the region (greatest reasonably possible storm runoff), or fractions thereof. Because of the magnitude and rarity of such a storm event, a finding that a spillway will not pass the test flood should not be interpreted as necessarily posing a highly inadequate condition. The test flood provides a measure of relative spillway capacity and serves as an aide in determining the need for more detailed hydrologic and hydraulic studies, considering the size of the dam, its general condition and the downstream damage potential.



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(10) John E. Fisher (15) DACW51-79-C-0001

(11) 28 Aug 80

(6) PHASE I REPORT
NATIONAL DAM SAFETY PROGRAM

Name of Dam Clarks Mills Dam, NY120 (Inventory Number NY 153)

(12) 153

State Located [redacted]
County Located Washington County, New York
Stream Batten Kill (Upper Hudson-Hoosic Basin)
Date of Inspection April 21, 1980, July 16, 1980 Phase I Inspection Report

ASSESSMENT OF GENERAL CONDITIONS

The examination of documents and visual inspection of the dam and appurtenant structures did not reveal conditions which constitute an immediate hazard to human life or property. The dam, however, has a number of problem areas which should be investigated, evaluated, and remedied.

The structural stability analysis indicates the south portion (left side looking downstream) of the structure demonstrates unsatisfactory stability under loading conditions which could occur during winter operation (including ice loading) and during the Probable Maximum Flood (PMF) and 1/2 PMF conditions. Lack of dimensions and design data for the north portion of the spillway did not allow the structural analysis of this section of the structure to be performed. A detailed investigation of the structural components of the northerly spillway section should be commenced within 6 months and followed with a structural investigation of the entire dam section to determine the measures necessary to increase the structural stability of the installation. The walkway through the interior of the north portion of the dam should be repaired to allow inspections to the interior of the dam. The remedial work necessary to increase the structural stability of the facility should be completed within two years.

Hydrologic/hydraulic analysis performed in accordance with the Corps of Engineers Recommended Guidelines for Safety Inspection of Dams establishes the spillway capacity as 16% of the Probable Maximum Flood (PMF). The dam will be overtopped by 15.66 feet and 7.47 feet by the PMF and 1/2 PMF respectively. Since failure of the southerly section of the dam under the 1/2 PMF will not significantly increase the downstream hazard to loss of life from that which would exist just prior to a dam failure during this 1/2 PMF event, the spillway is assessed as inadequate.

Leakage is occuring through the concrete into the core of the Northerly, Ambursen-Type-Section. Extensive deterioration has taken place at the north abutment and at the pier separating the two sections.

5/2 NC

The following remedial measures should be undertaken within one year:

1. Eliminate leakage into the interior core of the dam and repair deteriorated concrete on the north abutment and at the pier separating the two sections of the dam.

2. A formalized inspection program should be initiated to develop data on conditions and maintenance operations at the facility.

3. A flood warning and emergency evacuation plan should be developed and implemented to alert the public in the event conditions occur which could result in failure of the dam.

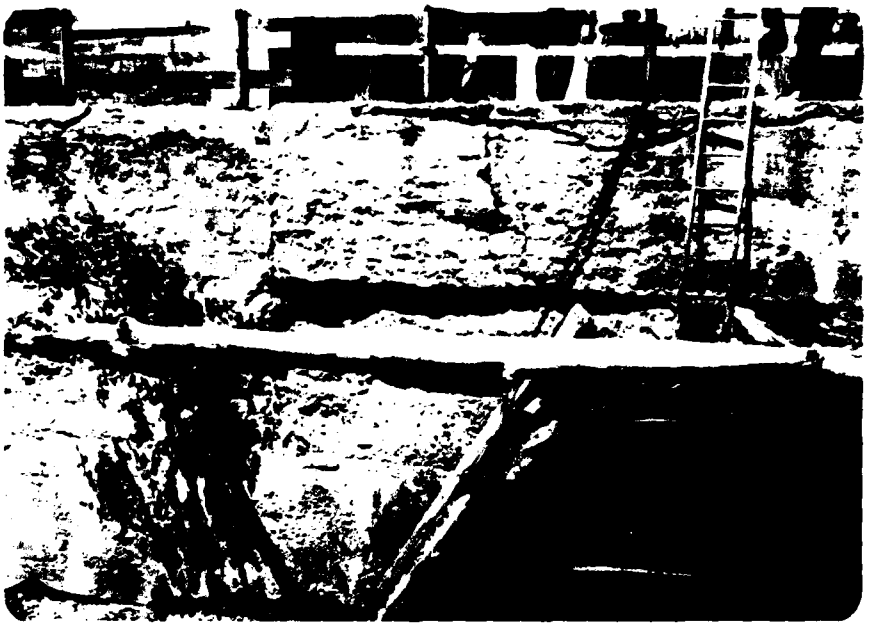
Dale Engineering Company

John B. Stetson, President

Approved By:
Date: 28 AUG 1980

Col. W.M. Smith, Jr.
New York District Engineer

1. View of Dam from downstream.



2. North abutment showing surface deterioration.

3. Close-up of deteriorated concrete on north abutment.

4. Deterioration at crest of spillway.

5. View of former south abutment. Dam was extended 90 feet to new abutment, see photo #6.

6. South abutment.

7. View of residences approximately 11 feet above creek level just downstream from the dam.

8. View of Dam from south abutment.

PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM
NAME OF DAM - CLARKS MILLS DAM ID# - NY 120

SECTION 1 - PROJECT INFORMATION

1.1 GENERAL

a. Authority

Authority for this report is provided by the National Dam Inspection Act, Public Law 92-367 of 1972. It has been prepared in accordance with a contract for professional services between Dale Engineering Company and The New York State Department of Environmental Conservation.

b. Purpose of Inspection

The purpose of this inspection is to evaluate the existing condition of the Clarks Mills Dam and appurtenant structures, owned by the Hollingsworth and Vose Company, and to determine if the dam constitutes a hazard to human life or property and to transmit findings to the State of New York.

This Phase I inspection report does not relieve an Owner or Operator of a dam of the legal duties, obligations or liabilities associated with the ownership or operation of the dam. In addition, due to the limited scope of services for these Phase I investigations, the investigators had to rely upon the data furnished to them. Therefore, this investigation is limited to visual inspection, review of data prepared by others, and simplified hydrologic, hydraulic and structural stability evaluations where appropriate. The investigators do not assume responsibility for defects or deficiencies in the dam or in the data provided.

1.2 DESCRIPTION OF PROJECT

a. Description of Dam and Appurtenances

The Clarks Mills Dam is located on the Batten Kill, approximately 4,000 feet upstream from the Hamlet of Clarks Mills. The dam is a reinforced concrete structure of Ambursen type, buttressed construction, approximately 340 feet long and 21 feet high. An abandoned mill structure formerly used as a pulp grinding mill forms the north abutment of the dam. The spillway of the structure spans the entire width of the Batten Kill from the pulp mill to the south abutment. Flow into the forebay of the pulp grinding mill is controlled through

9, 8 foot by 8 foot sluice gates. These gates are presently in the closed position and the entire flow is presently directed across the spillway of the dam. Plans indicate that the structure is founded on bedrock.

b. Location

The Clarks Mills Dam is located in the Town of Greenwich and the Town of Eaton, Washington County, New York.

c. Size Classification

The maximum height of the dam is approximately 21 feet. The storage volume of the impoundment is approximately 875 acre feet. Therefore, the dam is in the Small Size Classification as defined by the Recommended Guidelines for Safety Inspection of Dams.

d. Hazard Classification

The Batten Kill flows approximately 6,500 feet to its mouth at the Hudson River. A paper mill owned by Hollingsworth and Vose Company is situated on the bank of the Batten Kill, approximately 4,000 feet downstream from the structure. A laboratory building is situated on the bank of the creek approximately 7 feet above the normal creek level. Therefore, the dam is in the High Hazard Category as defined by the Recommended Guidelines for Safety Inspection of Dams.

e. Ownership

The dam is owned by Hollingsworth and Vose Company.

Contact: Leonard A. Simpson
Mill Manager - New York Mills
Greenwich, New York 12834
Telephone: 518-695-3266

f. Purpose of the Dam

The dam was originally used to supply water as a source of power for the pulp grinding mill, owned by Hollingsworth and Vose Company. This use was abandoned in the 1960's. The dam is presently used to maintain a pool for recreational and environmental purposes.

g. Design and Construction History

A 1916 dam report by the State of New York Conservation Commission indicates that the dam was built in about the year 1904. In 1928, the south abutment of the dam was removed and the dam was lengthened by approximately 90 feet. This extension of the spillway section is evident in the photographs.

h. Normal Operational Procedures

The facility is operated by the Hollingsworth and Vose Company. The facility has been used to maintain a pool for recreational and aesthetic purposes since its abandonment as a source of power in the 1960's. Flow is allowed to crest the spillway section at all times.

1.3 PERTINENT DATA

a. Drainage Area

The drainage area of the Clarks Mills Dam, ID# NY120, is 440.9 square miles.

b. Discharge at Dam Site

No discharge records are available for this site.

Computed Discharges:

Ungated Spillway, Top of Dam	23,350 cfs
Gated Drawdown (48 Inch Drain)	275 cfs (Water Surface @ Elev. 134)

c. Elevation (Feet Above MSL)

Top of Dam	141
Spillway Crest	134
Stream Bed at Centerline of Dam	113

d. Reservoir

Length of Normal Pool	8000± FT

e. Storage

Top of Dam	1500 Acre Feet
Normal Pool	875 Acre Feet

f. Reservoir Area

Top of Dam	104 Acre
Spillway Pool	83 Acre

g. Dam

Type - North Section - Reinforced Concrete, Ambursen Type, Buttressed Construction.
- South Section - Concrete Gravity.
- North Section - 250 Feet
- South Section - 90 Feet

Length - 340 Feet.
Height - 21 Feet.
Freeboard Between Normal Reservoir and Top of Dam - 7 Feet.

Top Width - 4.5 Feet.
Side Slopes - Upstream - Vertical; Downstream - 1 Horizontal, 1.75 Vertical (South Section). (No Data available on North Section.)

Zoning - N/A.
Impervious Core - N/A.
Grout Curtain - None.

h. Spillway

Type - Ogee Crest.
Length - 340 Feet.
Crest Elevation - 134.
Gates - None.
U/S Channel - Impoundment.
D/S Channel - Natural.

i. Regulating Outlets

9 sluice gates, 8 feet x 8 feet, controlling flow through an abandoned pulp grinding mill.
1 - 48 inch reservoir drain.

SECTION 2 - ENGINEERING DATA

2.1 GEOTECHNICAL DATA

No records of subsurface investigations performed for this structure were available. The only information which was available was taken from the application for reconstruction of the dam in 1928. This application states that the natural material on which the proposed dam will rest is "Hudson River Shale." The application further states that the material on the left bank is "clay." This application is included in Appendix B.

2.2 DESIGN RECORDS

No records were available from the original design of the dam. The reconstruction of the dam in 1928 consisted of the extension of the left abutment, approximately 90 feet. The plan for this reconstruction is included in the report as Figure 8.

2.3 CONSTRUCTION RECORDS

No information was available concerning either the original construction of the dam or the reconstruction of the left abutment.

2.4 OPERATION RECORDS

There are no operation records available for this dam.

2.5 EVALUATION OF DATA

The data presented in this report was obtained from the Department of Environmental Conservation files. The information appears to be reliable and adequate for a Phase I inspection report.

SECTION 3 - VISUAL INSPECTION

3.1 FINDINGS

a. General

The Clarks Mills Dam was inspected on April 21, 1980. The Dale Engineering Company Inspection Team was accompanied on the inspection by Leonard A. Simpson, Mill Manager of Hollingsworth and Vose Company and Walter Lynick, New York State Department of Environmental Conservation, Dam Safety Section. A subsequent inspection was conducted on May 16, 1980. The inspection team was accompanied by Don Stevenson of Hollingsworth and Vose Company.

b. Dam

At the time of the first inspection, water was cresting the spillway at a depth of approximately 1 foot. This flow obscured the spillway from view, however, some surface deterioration of the crest was evident through the water and the irregularity of the flow on the downstream face of the spillway indicated some deterioration in the concrete. Surface deterioration in the abutment walls extends to a depth of approximately 8 inches. Visual observation during the inspection did not disclose physical displacement of the alignment of this structure. The observations made at this inspection did not indicate evidence of structural instability.

The second inspection provided a closer examination of the surface of the spillway. Moderate deterioration of the downstream face of the spillway exists throughout its length. Approximately 8 inches of the upstream face of the concrete has eroded just below the crest in one small area. Horizontal joints also shown some erosion. The former west abutment which still exists is severely deteriorated. (See Photos).

The interior of the cells of the dam were observed only from the pulp mill entrance to the walkway. The deteriorated conditions of the walkway did not permit a thorough inspection of the interior. Leakage through the concrete was evident near the north abutment and near the south abutment. The leakage was not severe at the time of the inspection. The center of the dam showed little leakage in the areas which were viewed from the walkway entrance.

c. Appurtenant Structures

An abandoned pulp grinding mill forms the north abutment of the dam. This pulp mill was abandoned in the 1960's. The flow through the mill was controlled by 9 sluice gates. Water flowing through the penstocks provided mechanical power for grinding wood pulp. The interior of the building is strewn with debris and is presently in poor condition. The gates controlling flow into the forebay were in the fully opened position during the second inspection. The

Mechanical lifting equipment which manipulates the gates are in serviceable condition, however, poorly maintained.

d. Control Outlet

The flow from the impoundment is controlled by manipulating the gates into the forebay of the pulp grinding mill and also by operation of a 48 inch diameter gate controlling flow through a steel waste pipe. The mechanism controlling this outlet appears to be in operating condition.

e. Reservoir Area

The reservoir area extends approximately 8,000 feet upstream. There are no known areas of bank instability in this area.

f. Downstream Channel

The downstream channel is the natural stream bed of the Batten Kill. No evidence of recent erosion was noted in the downstream channel.

3.2 EVALUATION

The concrete surfaces are in a deteriorated condition and leakage occurs through joints and/or cracks in the concrete. Continual lack of maintenance will allow these conditions to become more severe to the point where they may become critical. A thorough investigation of the leakage into the interior cells should be conducted. The walkway through the interior of the dam should be repaired to allow inspection of the dam's interior. Remedial work should then be undertaken to eliminate the leakage. Repairs should also be made to the deteriorated exterior concrete surfaces.

The visual inspection of the dam did not disclose displacement of the alignment of the structure. There was no evidence noted in the inspection which would indicate structural instability of the facility.

SECTION 4 - OPERATIONAL PROCEDURES

4.1 PROCEDURES

At the present time, the Clarks Mills Dam is not utilized by Hollingsworth and Vose. The gates feeding the pulp grinding mill are in the closed position so as to maintain a recreational pool.

4.2 MAINTENANCE OF THE DAM

Maintenance and operation of the dam is controlled by the Hollingsworth and Vose Company. The site has presently been abandoned by the Company and there is no scheduled inspection or maintenance of the facility. Inspection of the interior of the north section of the dam is presently impeded by the lack of a walkway through the interior of the dam.

4.3 MAINTENANCE OF OPERATING FACILITIES

The gates controlling flow to the pulp grinding mill are presently closed. The equipment is poorly maintained but in operating condition.

4.4 DESCRIPTION OF WARNING SYSTEM

No warning system is in effect at present.

4.5 EVALUATION

The facility in its present condition is unmaintained and in a deteriorated condition. Continued neglect will eventually lead to serious problems, both with the mechanical equipment and the structural elements of the dam. The Owner should institute a system of periodic inspections in order to detect worsening conditions at the structure. A warning system should be placed in effect to alert downstream inhabitants, should conditions occur which could cause a dam failure.

SECTION 5 - HYDROLOGIC/HYDRAULIC

5.1 DRAINAGE AREA CHARACTERISTICS

The Clarks Mills Dam is located in the southeast portion of Washington County. The dam is situated on the Batten Kill approximately 1-1/2 miles upstream of its confluence with the Hudson River. The Batten Kill has its headwaters in Peru, Vermont and flows southwesterly through Vermont into New York where it flows generally in a westerly direction to its confluence with the Hudson River near Schuylerville, New York. Upstream of the dam site, the Batten Kill has a drainage area of approximately 440 square miles.

5.2 ANALYSIS CRITERIA

The purpose of this investigation is to evaluate the dam and spillway with respect to their flood control potential and adequacy. This has been assessed through the evaluation of the Probable Maximum Flood (PMF) for the watershed and the subsequent routing of the flood through the reservoir and the dam's spillway system. The PMF event is that hypothetical flow induced by the most critical combination of precipitation, minimum infiltration loss and concentration of run-off of a specific location that is considered reasonably possible for a particular drainage area. The dam is in the Small Dam Category and is a High Hazard. The hydrologic/hydraulic analysis is performed to determine the capacity of the spillway and to determine the extent of the overtopping of the dam which could occur during the PMF. In establishing the spillway capacity, it was assumed that no flashboards were in place on the spillway. This dam previously had provisions for flashboards, but the pipe supports are presently bent over onto the crest. It should be noted that the placement of flashboards will further decrease the spillway capacity so that overtopping of the dam could occur at lesser flows than those indicated in this analysis if the flashboards did not fail before the dam was overtopped.

The hydrologic analysis was performed using the unit hydrograph method to develop the flood hydrograph. Due to the limited scope of this Phase I investigation, certain assumptions, based on experience and existing data were used in this analysis and in the determination of the dam's spillway capacity to pass the PMF. In the event that the dam could not pass one-half the Probable Maximum Flood without overtopping, additional analyses are to be performed on potential dam failures if the dam is designated as a High Hazard Classification. This process was done with the concept that if the dam was unable to satisfy this criteria, further refined hydrologic investigations would be required.

An HEC-1 computer model for the basin was published by the New York District Corps of Engineers in a report entitled Upper Hudson and Mohawk River Basins Hydrologic Flood Routing Models, dated October 1976 (Ref. 19). This report was reviewed for the purpose of this

investigation and the model which was used for the preparation of this report was obtained from the New York District. The model was recoded and executed for analysis of the PMF. No changes were made to the unit hydrograph, base flow, loss rate or routing parameters. A sub-area was added to the model to determine flows at the Clark Mills Dam. The unit hydrograph parameters and base flow for this new sub-area were estimated from equations presented in the aforementioned report.

The U.S. Army Corps of Engineers' Hydrologic Engineering Center's Computer Program HEC-1DB was utilized to evaluate the PMF hydrology. The Probable Maximum Precipitation (PMP) was 18.5 inches according to Hydrometeorological Report (HMR #33) for a 24-hour duration storm, 200 square mile basin. The loss rates used in the PMF analysis were those used in the Transposed Agnes Storm and SPF analysis published in the Upper Hudson and Mohawk River Basins report. These loss rates incorporated an initial abstraction of 1.0 to 1.25 inches and a continuous loss rate of 0.075 inches/hour. The loss rate function yielded 83 percent run-off from the PMF. The peak for the PMF inflow hydrograph was 147,893 cfs and the 1/2 PMF inflow peak was 73,946 cfs. The small storage capacity of the reservoir reduced these peak flows a negligible amount to 147,778 cfs for the PMF and 73,874 for the 1/2 PMF.

5.3 SPILLWAY CAPACITY

The northern portion of the spillway is an Ambursen-type structure with sloping faces and rounded crest, whereas the southern (newer) portion of the spillway is Ogee shaped. Weir coefficients ranging from 3.25 to 3.65 for the Ambursen section and 3.28 to 4.15 for the Ogee section over the heads encountered in routing the PMF were assigned for the spillway rating development. The discharge capacity of the spillway at the top of dam elevation is 23,350 cfs.

SPILLWAY CAPACITY

Flood	Peak Discharge	Capacity as % of Flood Discharge
PMF	147,778 cfs	15.8%
1/2 PMF	73,874 cfs	31.6%

5.4 RESERVOIR CAPACITY

The reservoir storage capacity was estimated from USGS mapping and available riverbed information at the Clark Mills Dam.

The resulting estimates of the reservoir storage capacity are shown below:

Top of Dam	1500 Acre-Feet
Spillway Crest	875 Acre-Feet

5.5 FLOODS OF RECORD

There are no accurate records of flood discharges at the site. The maximum recorded discharge at USGS gage number 013295000 in Battenville, New York, is 21,300 cfs on November 4, 1927 (Ref. 20). This gage is located upstream of the dam site and has a drainage area of 394 square miles. The period of record for this gage is 1923 through 1968.

5.6 OVERTOPPING POTENTIAL

The HEC-1DB analysis indicates that the dam will be overtopped as follows:

Flood	Maximum Depth Over Dam
PMF	15.66 Feet
1/2 PMF	7.47 Feet

Stability calculations indicate the southern spillway section to be unstable under 1/2 PMF loading, therefore, a dam break analysis was performed to determine the significance of various dam failures on the downstream hazard. This analysis was performed with the 1/2 PMF assuming this 90 foot portion of the dam to fail at slightly below the maximum elevation resulting from the 1/2 PMF. This condition represents the worst case that could result from the 1/2 PMF, with regards to the flood discharges in the downstream area. The information available for the stability analysis was inadequate to determine the exact water elevation necessary to induce failure of the dam, therefore, this assumption was made for comparison purposes. The flood elevations, due to various dam failures and the flood elevations that would exist just before the corresponding dam break induced flood wave are shown below. These flood elevations are compared at the houses approximately 600 feet downstream of the dam and at the Hollingsworth and Vose Company laboratory near the downstream dam.

	Flood Elevations @ Houses 600 Feet Downstream		Flood Elevations @ Downstream Dam	
	Just Prior to Dam Break	Due to Dam Break	Just Prior to Dam Break	Due to Dam Break
Failure Time = 0.1 hrs.	120.6	121.4	116.1	117.0
Failure Time = 0.3 hrs.	120.6	122.2	116.1	117.9
Failure Time = 0.5 hrs.	120.6	121.8	116.1	117.6

The above elevations were estimated from USGS quad sheets and available information on the downstream dam. These elevations are not exact and their significance is in the differences between the elevations for the flood levels with and without the dam failure. The maximum difference determined by this analysis is approximately 1.6

feet at the houses just downstream of the dam and 1.8 feet at the downstream dam. Results of this analysis indicate the downstream hazard would not be significantly increased by a failure of the southern spillway section during the 1/2 PMF.

5.7 EVALUATION

Hydrologic/hydraulic analysis performed in accordance with the Corps of Engineers Recommended Guidelines for Safety Inspection of Dams establishes the spillway capacity as 16% of the Probable Maximum Flood (PMF). The dam will be overtopped by 15.66 feet and 7.47 feet by the PMF and 1/2 PMF respectively. Failure of the southerly section of the dam under the 1/2 PMF will not significantly increase the downstream hazard to loss of life from that which would exist just prior to a dam failure during this 1/2 PMF event. Therefore, the spillway is assessed as inadequate, according to the Corps of Engineers screening criteria.

SECTION 6 - STRUCTURAL STABILITY

6.1 EVALUATION OF STRUCTURAL STABILITY

a. Visual Observations

This concrete dam is sited at a location along the Batten Kill adjacent to a former pulp grinding mill which presently is being used only as a storage facility. The dam's axis extends in the north-south direction, with the mill building and its gated-intake structure on the north shore also serving as the north abutment for the dam. This dam consists of two sections, a northerly section on the order of 250 feet in length and a southerly segment some 90 feet in length. A concrete abutment structure separates the two dam sections. Apparently the northerly section represents the original dam at this site, with the southerly section constructed at a subsequent time. The northerly section is a buttressed, Ambursen-type structure, while the southerly section is a gravity structure.

Observations indicate the dam is situated on rock, as is the center abutment. The south abutment adjoins earth.

Both dam sections function as spillways. Some flow was passing over the spillways at the time two field inspections were performed. Visually, the dam retains structural stability with no indication of structural displacement evident. However, the concrete surfaces of the spillway sections and abutment structures are experiencing varying degrees of deterioration and spalling, some of which is becoming significant, e.g., deep spalling and erosion of material, and erosion at construction joints. With the spillways being crested, the occurrance of thru-the-dam and abutment leakage could not be ascertained, though restricted observation of the north section's interior did indicate water leakage is present. Similarly, the foundation area at the dam's toe and downstream could not be inspected for indications of seepage and erosion.

b. Geology and Seismic Stability

Geologically, the area is located within the Hudson Valley section of the Valley and Ridge Province.

Both the spillway and dam foundation are sited on bedrock. According to the 1928 State Dam Report, the left bank of the dam is "clay." Bedrock in this locale is the Middle Ordovician Canajoharie Shale. This rock is a dark gray shale with occasional thin, sandy and sandy limestone layers. Structurally, the rock shows closely packed, small closed folds that are asymmetric and overturned to the west. All beds dip to the east with varying angles. Downstream of the north abutment, the outcrop orientation ranges from N10°E with a dip of 56°SE to N25W with a dip of 55°NE. Orientation of the rock is thus approximately parallel to that of the dam. One prominent joint set noted during the field inspection had an east-west orientation with a dip of about 90°.

Bedding plane slickensides are present indicating the presence of shearing. According to Cushing and Ruedeman (1914, p. 103, Ref. 14) innumerable slip planes or small thrust faults are present in the area. These small overthrusts rise toward the west and have displacements of a few inches to a few feet. Such evidence of deformation in this area is probably related to the Ordovician Taconic Orogeny which affected much of the New England region. The Georgian overthrust block, about one mile east of the dam site and shown on this report's Geologic Map, Figure 9, was probably created during the Taconic Orogeny.

Information on some of the larger earthquakes for the area is tabulated below. Many earthquakes of lesser intensity are known to have occurred in this region, according to the records of the New York State Geological Survey. The seismic probability map locates this dam in an area having a Zone 2 Designation.

Date	Intensity Modified Mercalli	Location Relative to Dam
1847	III	15 mi. NW
1855	IV	21 mi. NW
1916	V	15 mi. NW
1917	III	12 mi. NNW
1921 (1)	IV	15 mi. NW
1921 (2)	IV	15 mi. NW
1931	VII	21 mi. NW
1955	V	18 mi. SW

c. Stability Evaluation

Design drawings available for review show plan alignment and the cross-section for the southerly spillway but do not include sufficient information on the northerly spillway to perform a stability analysis of that section. The available data does not include information on the properties of the dam and foundation materials, nor stability analysis. As part of the present study, stability evaluations have been performed for the southerly spillway section. Actual properties of the spillway's construction materials and foundation were not determined as part of this study; where information on properties were necessary for computations but lacking, assumptions felt to be practical were made. The stability computations assumed a structural cross-section based on dimensions indicated by the plans included in this report. It should be considered that in areas where deterioration has occurred, section dimensions would be less than indicated by the plans, with some adverse affect on the structural strength expected. The analysis also assumed the dam section to be monolithic possessing necessary internal resistance to shear and bending occurring as a result of loading.

The results of the stability computations are summarized in the table following this page. The stability analysis are presented in Appendix D.

The analysis indicate the southern spillway section is stable under forces possible during normal, summer operations. Similarly, satisfactory stability is indicated when Zone 2 seismic effects are imposed in addition to the summer operations loading.

Unsatisfactory stability against overturning is indicated for the spillway section when subject to forces possible during normal winter operations including ice loading, according to the Recommended Guidelines for Safety Inspection of Dams (i.e., when the resultant of forces acting on the dam is located outside the middle third of the base, tensile stresses would develop in the section, a condition which is structurally undesirable.)

Instability is also indicated against overturning for the spillway subject to the 1/2 PMF loading effects. For the PMF loading condition, instability against overturning and inadequate resistance to sliding is indicated. The analysis of the 1/2 PMF and PMF condition assumed water pressures on the back and front faces of the dam section corresponding to the upstream and downstream flood levels respectively. Stability is expected where the structure is completely submerged (e.g., the difference in reservoir and downstream water levels does not occur in the vicinity of the dam).

Critical to the analysis and resulting indication of stability are the items of uplift water pressure acting on the base of the dam and relative permeability of the site's foundation rock. For the "normal operating conditions" case, the analysis uplift force was based on a full headwater hydrostatic pressure acting on the dam's upstream corner and a full tailwater hydrostatic pressure acting on the dam's downstream corner. Uplift pressures were assumed to vary linearly between the dam's upstream and downstream corners, and to act upon 100 percent of the dam base. The resulting uplift forces represents a factor that is significant to the indication of instability for the winter operations case.

Uplift as computed for the normal operating condition was also assigned to the flood conditions studied, assuming that uplift pressures would not increase significantly over a relatively short flood stage time period because of expected low foundation rock permeability. Should actual uplift pressures relate more closely to flood water levels, the uplift force would be increased and the factors of safety against overturning would be less than the already inadequate value indicated in the tabulation.

The discussed analysis applies to a spillway section in structurally good condition. The field observations indicate varying degrees of materials attrition, occurrences expected to have some adverse effect on actual stability.

RESULTS OF STABILITY COMPUTATIONS

SOUTHERLY GRAVITY SECTION

	Loading Condition	Factor of Safety* Overturning	Factor of Safety* Sliding**	Location of Resultant Passing through Base***
(1)	Normal operations with water level at spillway elevation, uplift on base.	1.62	9+	0.40b
(2)	Water level at spillway elevation, 7.5 kip per foot ice load acting, uplift on base.	1.05	6+	0.05b
(3)	1/2 PMF conditions, with water level against upstream face and downstream face based on 1/2 PMF elevations, uplift on base as computed for normal operating condition.	0.94	4.4	Outside of base (FS < 1)
(4)	PMF conditions, with water level against upstream face and downstream face based on PMF elevations, uplift on base as computed for normal operation condition.	0.80	3.2	Outside of base (FS < 1)
(5)	Normal operations condition plus seismic effect applicable to Zone 2.	1.43	9+	0.33b

* These factors of safety indicate the ratio of moments resisting overturning to those moments causing overturning, and the ratio of forces resisting sliding to those causing sliding.

** As determined, applying the friction-shear method.

*** Indicated in terms of the dam's base dimension, b, measured from the toe of the dam.

As a result of relating indications of stability and instability to the lack of definite information about key factors affecting the southerly spillway, further investigation is recommended. Similarly, investigation is also recommended to permit stability studies for the northerly spillway section to be performed. The additional investigation should include inspection and evaluation of the dam structure, including its interior, with the reservoir drawn down to check for through- the-dam and underdam seepage. The observed condition of the dam structure and rock foundation can serve as the basis for planning and conducting necessary tests for determining physical properties important to the dam's stability. Because of the effect on stability, methods to evaluate uplift should be undertaken. Stability analyses based upon actually existing conditions should be completed, and recommendations to improve the stability should be developed, if necessary. Meanwhile, maintenance and repair should be planned for deteriorated areas to ensure that the presently existing stability is retained.

SECTION 7 - ASSESSMENT/REMEDIAL MEASURES

7.1 DAM ASSESSMENT

a. Safety

The Phase I inspection of the Clarks Mills Dam on the Batten Kill did not indicate conditions which constitute an immediate hazard to human life or property.

The hydrologic/hydraulic analysis establishes the spillway capacity as 16% of the Probable Maximum Flood (PMF). The dam will be overtopped by 15.66 feet and 7.47 feet by the PMF and 1/2 PMF respectively. Failure of the southerly section of the dam under the 1/2 PMF will not significantly increase the downstream hazard to loss of life from that which would exist just prior to a dam failure during this 1/2 PMF event. Therefore, the spillway is assessed as inadequate according to the Corps of Engineers screening criteria.

The following specific safety assessments are based on the Phase I visual examination and analysis of hydrology and hydraulics and structural stability.

1. The visual inspection revealed minor deterioration on the crest of the spillway and at vertical joints in the spillway structure. Extensive deterioration was noted at the north abutment wall and at the pier which separates the two sections of the dam.

2. A cursory inspection of the interior of the buttressed section of the dam revealed leakage into the interior core.

3. The structural stability analysis indicates the south portion (left side looking downstream) of the structure demonstrates unsatisfactory stability under loading conditions which could occur during winter operations (including ice loading) and during the Probable Maximum Flood (PMF) and 1/2 PMF conditions. Lack of dimensions and design data for the north portion of the spillway did not allow the structural analysis of this section of the structure to be performed.

b. Adequacy of Information

The information available is adequate for this Phase 1 inspection report.

c. Urgency

The detailed investigation of the structural components of the northerly spillway section should be commensed within 6 months and followed with a structural investigation of the entire dam section to

determine the measures necessary to increase the structural stability of the installation. The remedial work necessary to increase the structural stability of the facility should be completed within two years.

d. Need for Additional Investigation

Additional investigations should be undertaken to fully evaluate the uplift forces acting at the base of the dam and should extend to the evaluation of the physical properties and stability of the northerly portion of the structure.

7.2. RECOMMENDED MEASURES

The following steps should be undertaken:

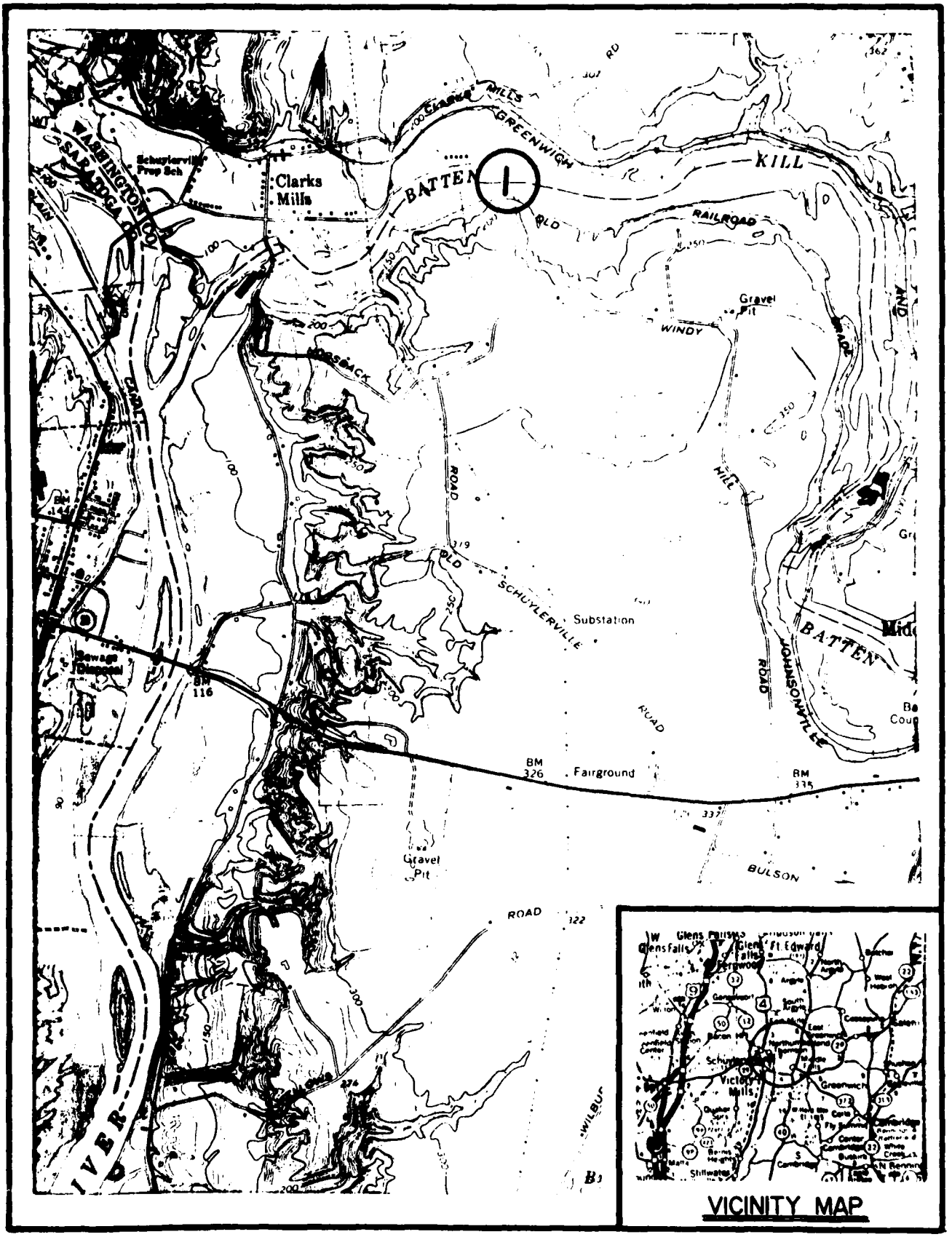
1. Complete the aforementioned structural investigations. The walkway through the interior of the north portion of the dam should be repaired to allow inspection of the interior of the dam.

2. Undertake any repairs necessary as indicated by the detailed structural evaluations and to stop leakage through the concrete.

3. Repair deteriorated concrete on the north abutment and at the pier separating the two sections of the dam.

4. A formalized inspection program should be initiated to develop data on conditions and maintenance operations at the facility.

5. A flood warning and evacuation plan should be developed and implemented to alert the public in the event conditions occur which could result in failure of the dam.



LOCATION PLAN

FIGURE 1

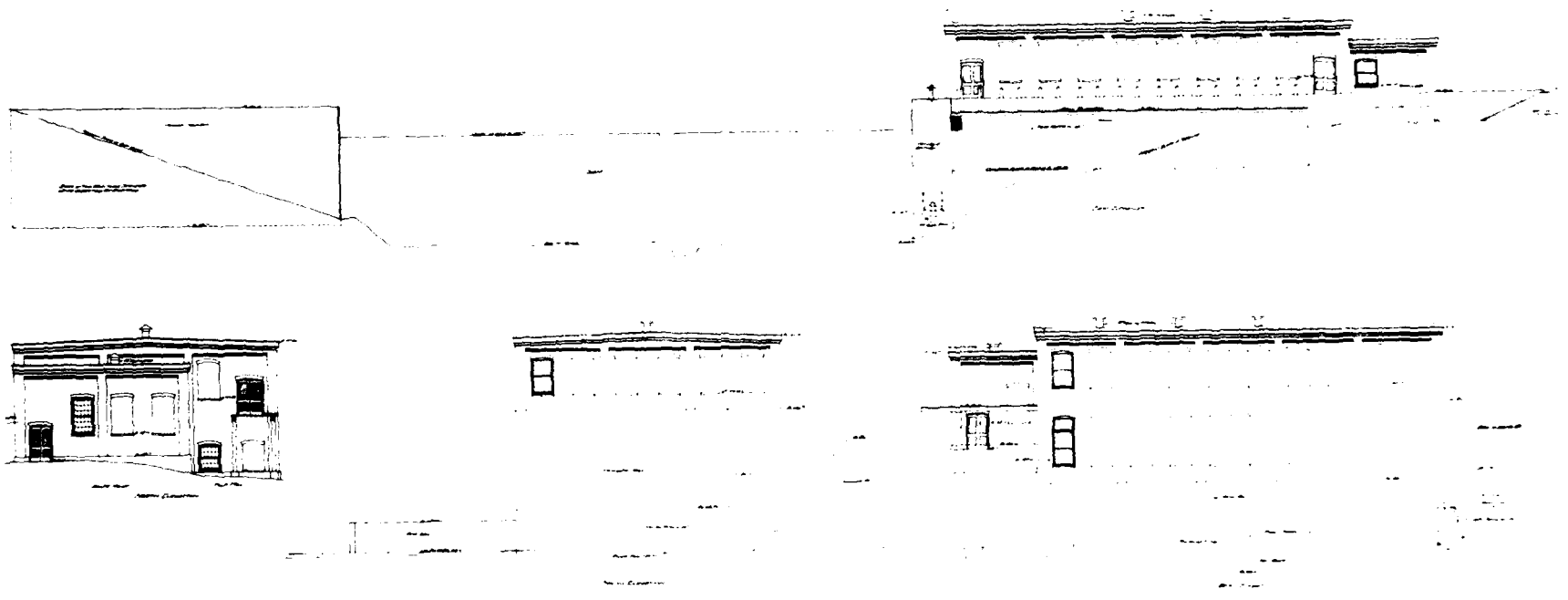


FIGURE 2

AMERICAN WOOD BOARD CO

A 117

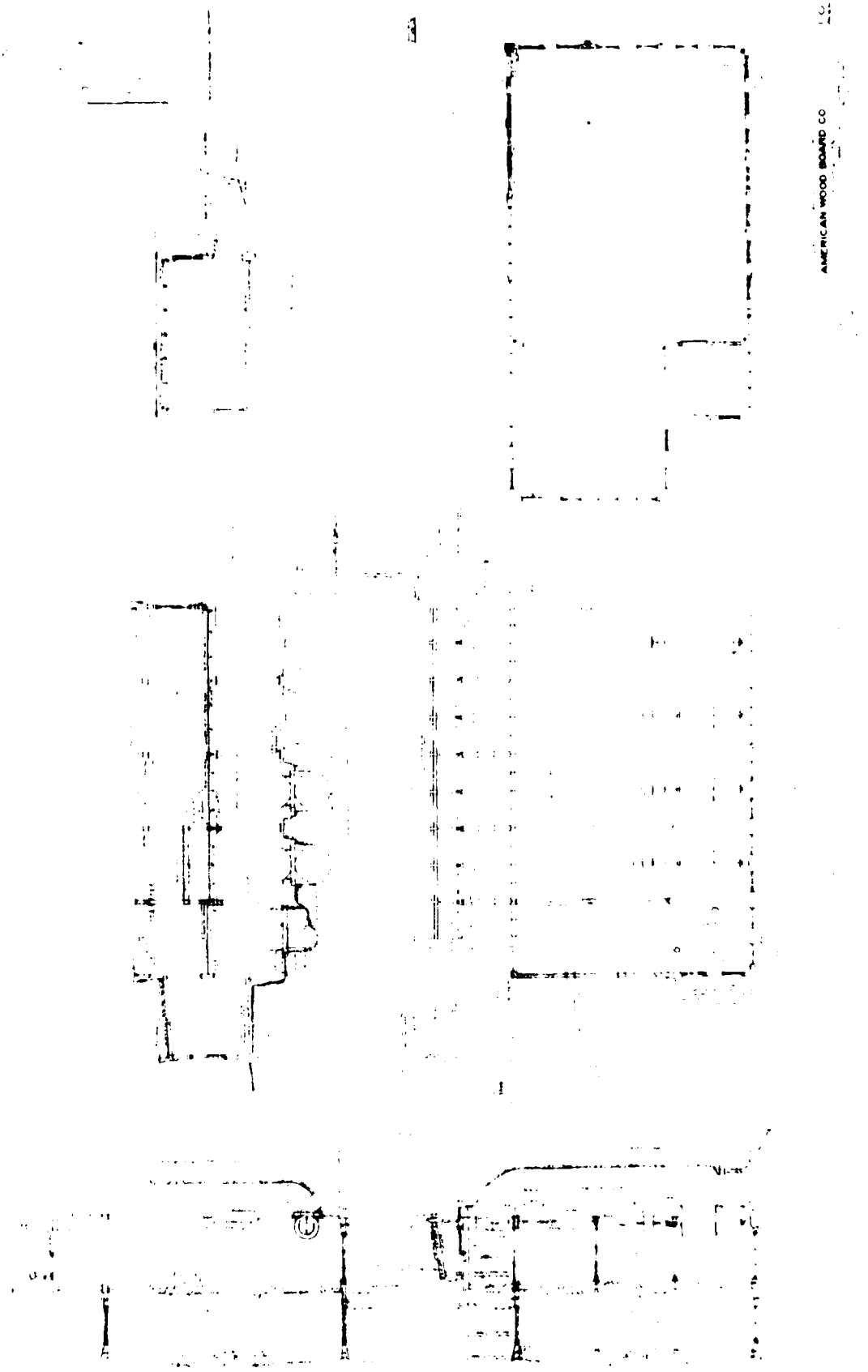


FIGURE 3

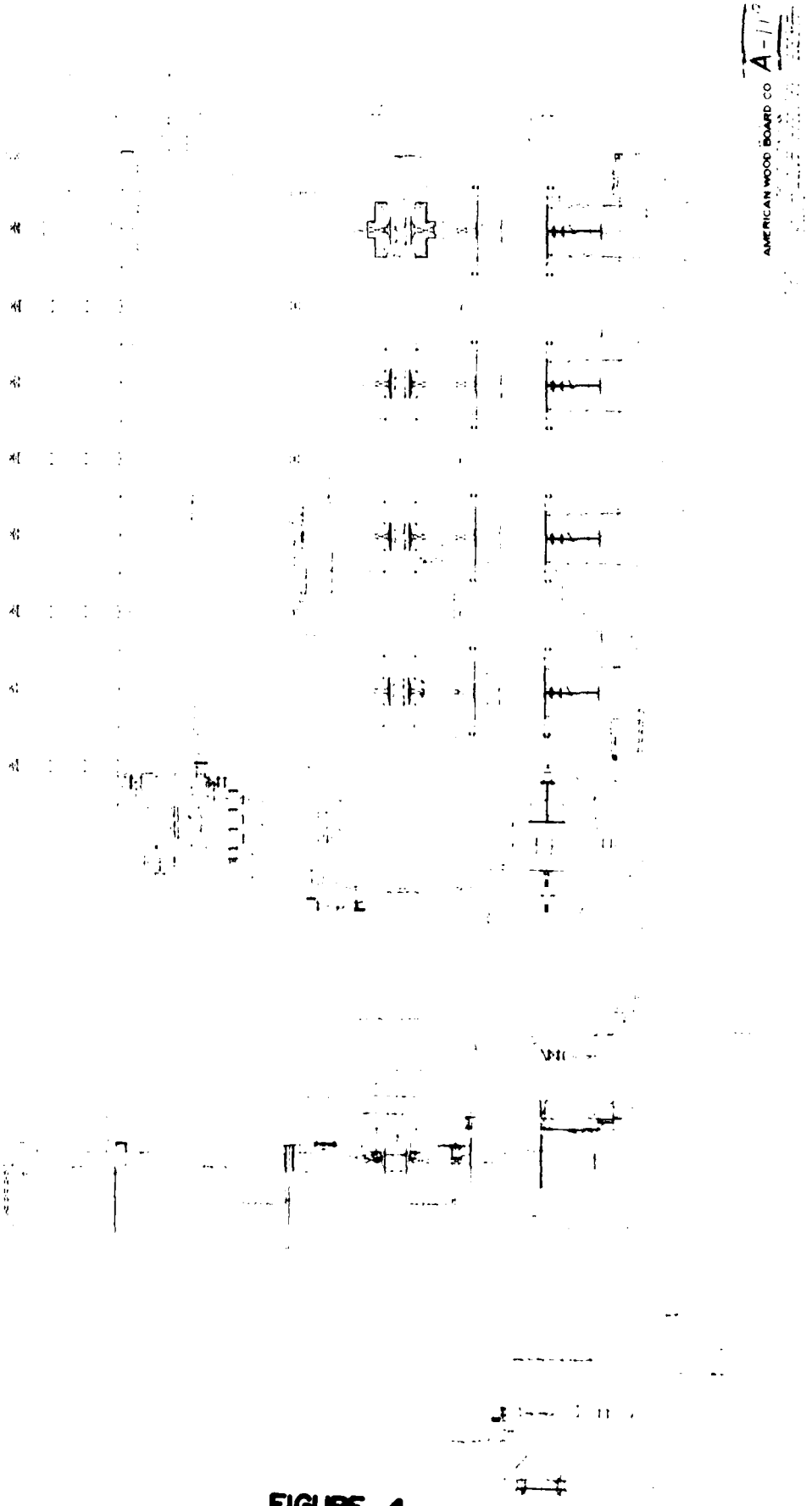


FIGURE 4

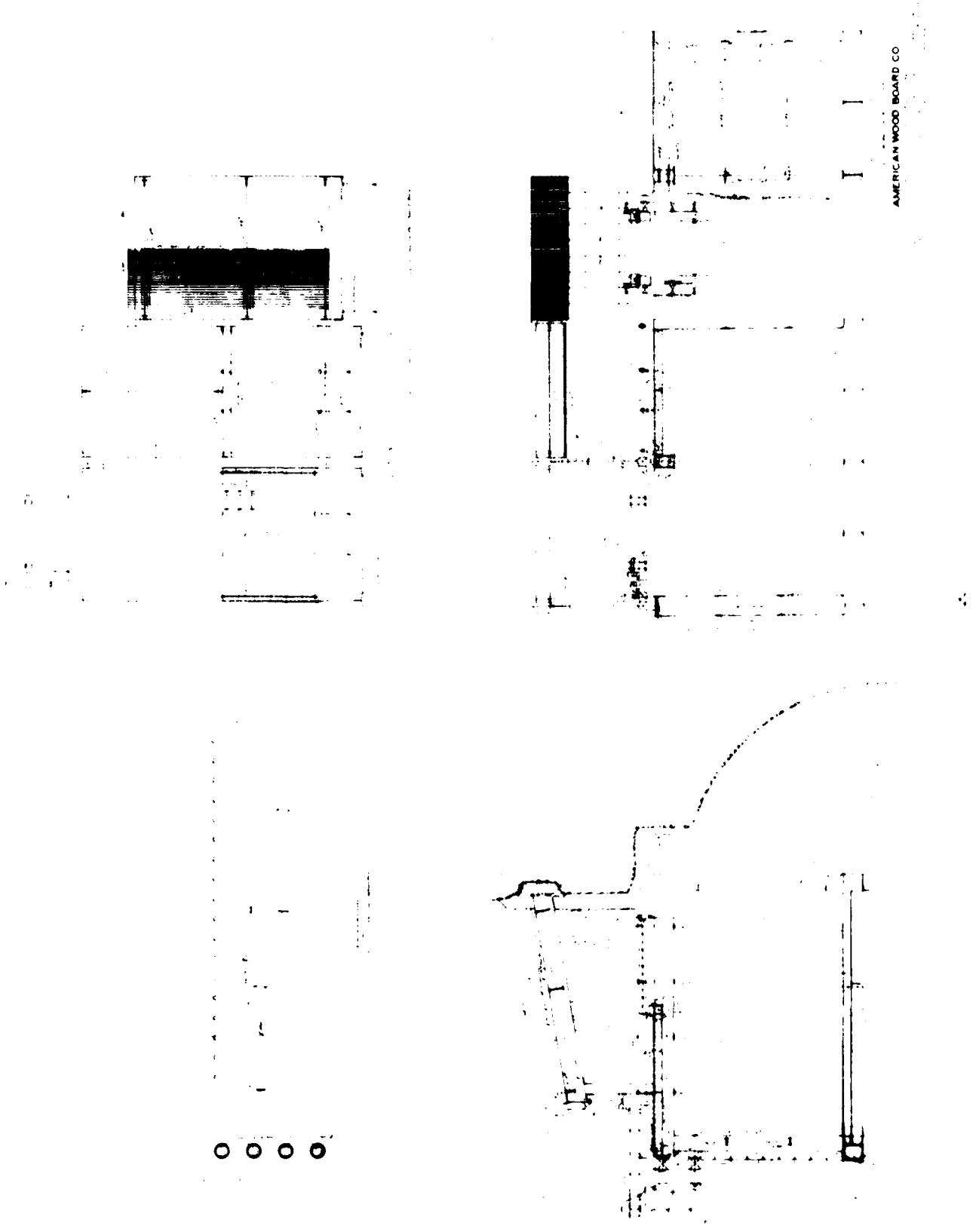


FIGURE 5

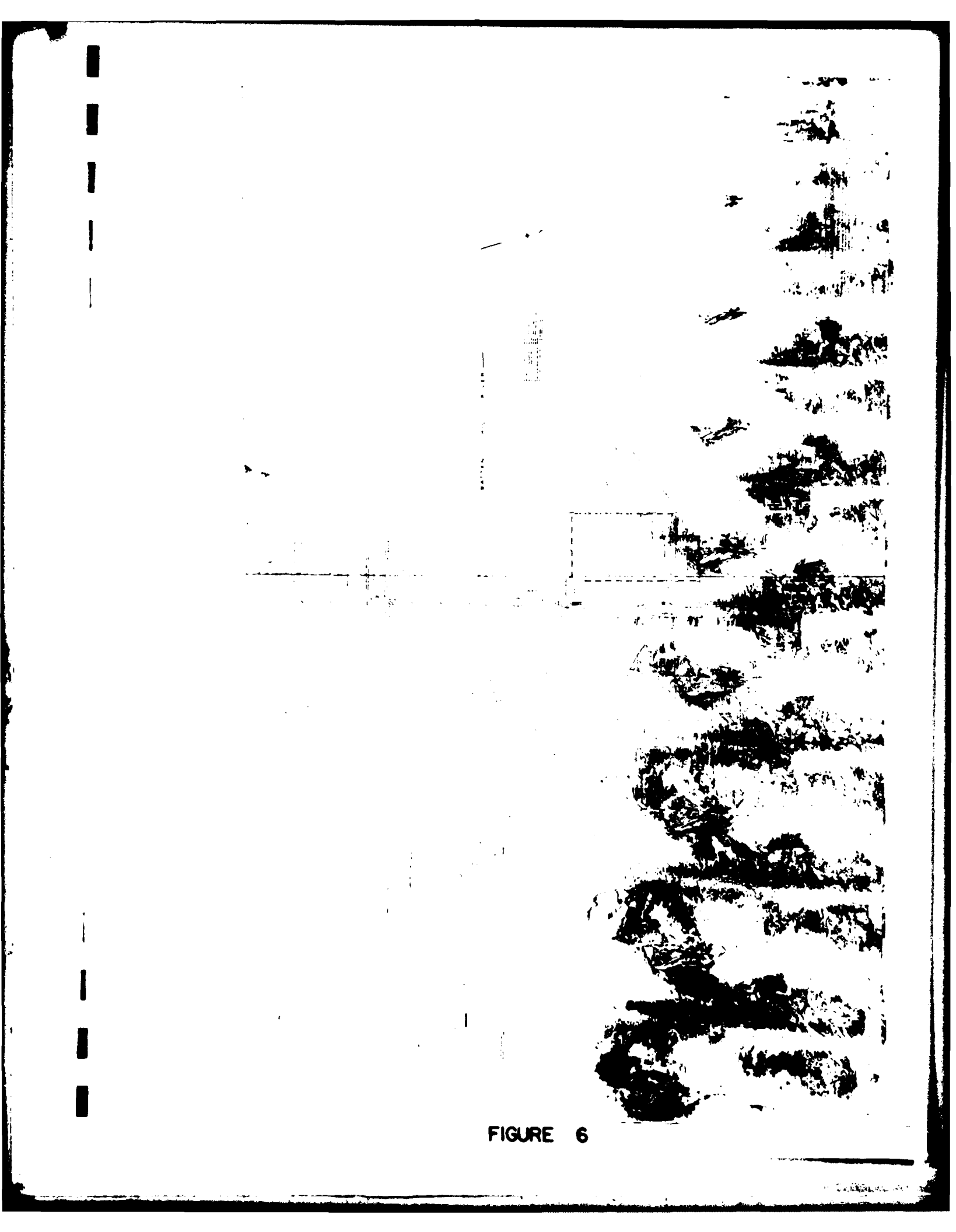


FIGURE 6

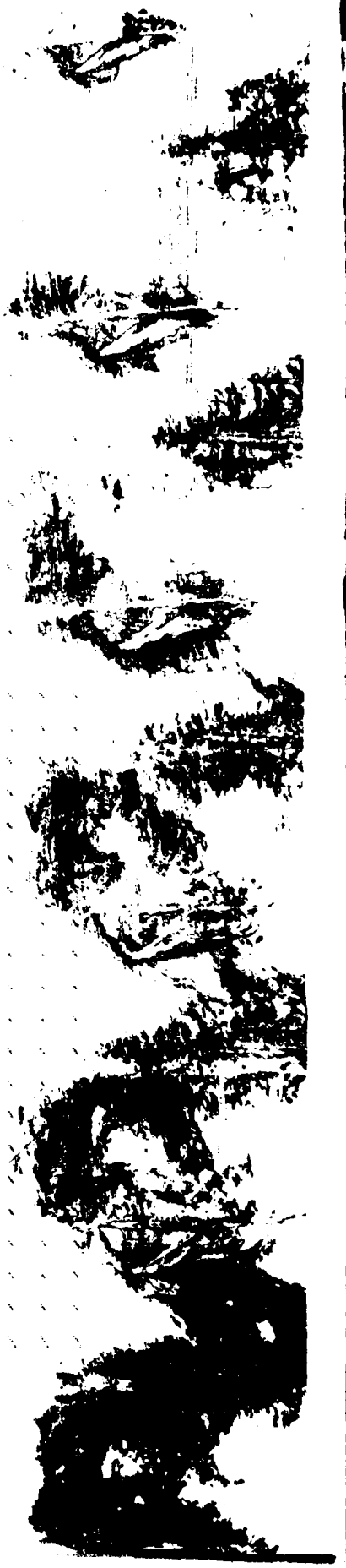


FIGURE 7

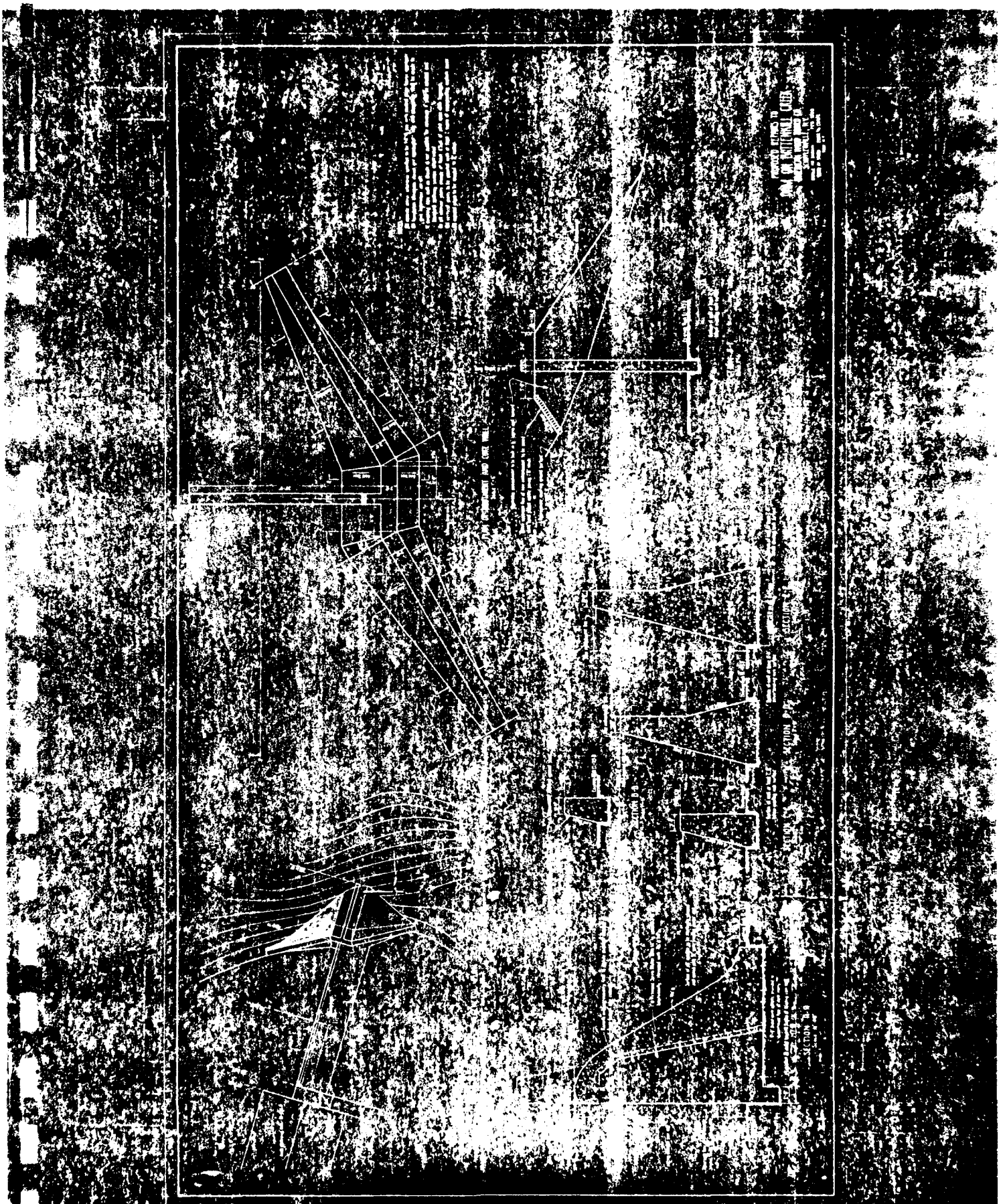
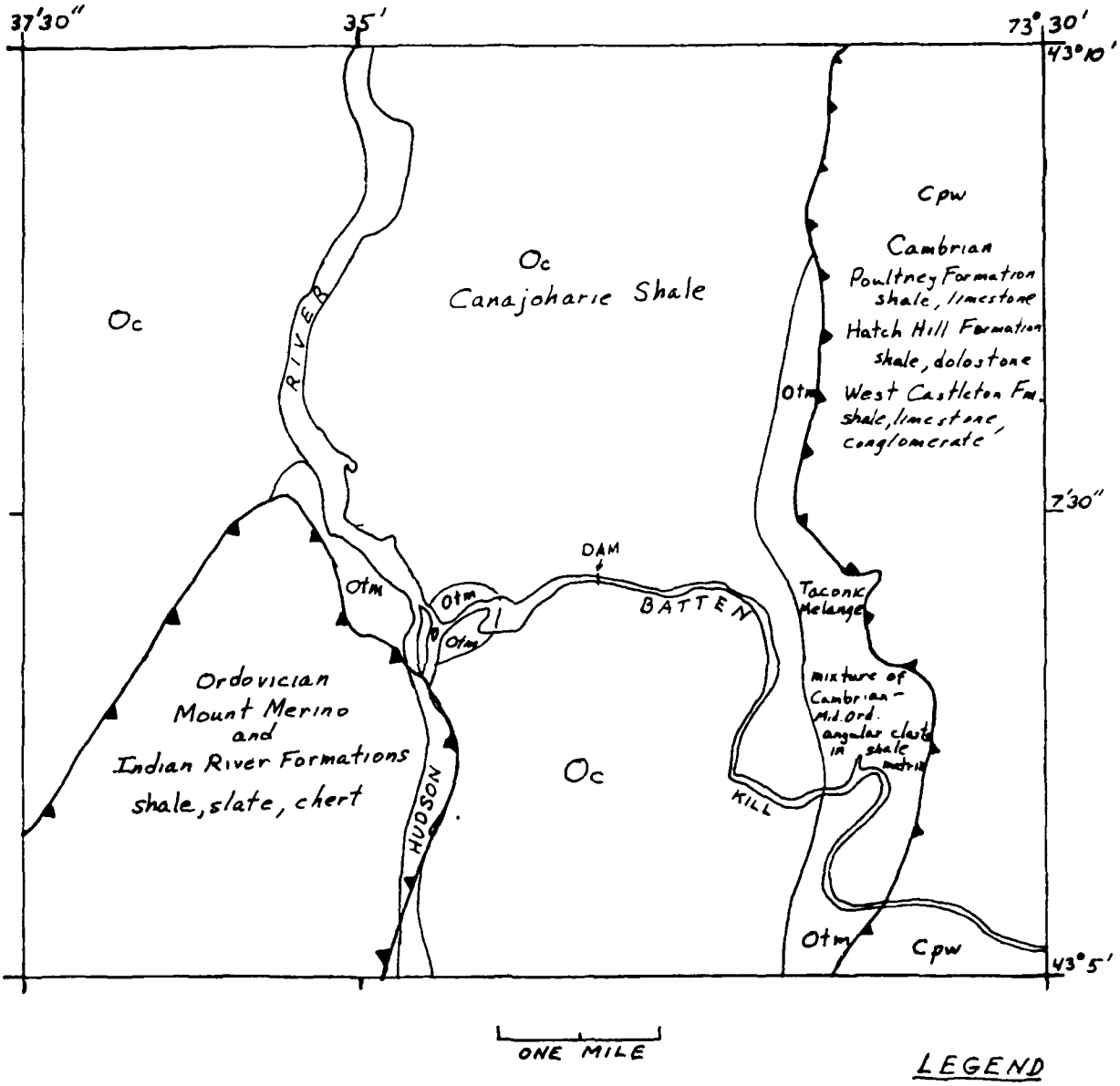


FIGURE 8



LEGEND

Thrust fault, teeth on over-thrust block

Rock unit contact

GEOLOGIC MAP

STETSON • DALE	DATE 6-2-80	DRAWN	FIGURE 9
	JOB 2399	APP'D	

APPENDIX A

FIELD INSPECTION REPORT

CHECK LIST
VISUAL INSPECTION

PHASE 1

Name Dam Clarks Mills **County** Washington **State** New York **ID #** NY-120

Type of Dam Concrete-Gravity **Hazard Category** High

Date(s) Inspection 1. April 21, 1980
2. May 16, 1980 **Weather** Sunny **Temperature** 60's

Pool Elevation at Time of Inspection 135.0 M.S.L. **Tailwater at Time of Inspection** No measurement

Inspection Personnel:

1&2	F. W. Byszewski	Dale Engineering Company	
1&2	J. A. Gomez	Dale Engineering Company	
1	D. F. McCarthy	Dale Engineering Company	
1	H. Muskatt	Dale Engineering Company	
1	L. A. Simpson	Mill Manager for Hollingsworth & Vose Co.	
2	D. Stevenson	Hollingsworth & Vose Co.	
1	W. Lynick	N.Y.S. Department of Environmental Conservation, Dam Safety Section	

J. A. Gomez **Recorder**

CONCRETE/MASONRY DAMS

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
ANY NOTICEABLE SEEPAGE	No seepage observed through concrete. Water was flowing over spillway at time of inspection obscuring face of spillway. Flow pattern of water during low flow did not indicate any seepage through southern section.	Looking through the interior corridor of the Ambursen section with a flashlight revealed some minor leakage. The condition of the walkway prevented a thorough inspection from this interior corridor. Further investigations should include a thorough investigation of the interior of the dam.
STRUCTURE TO ABUTMENT/EMBANKMENT JUNCTIONS	At least a 30 ft. long corewall extending from abutment into ground at south abutment. No signs of distress observed at structure to abutment/ embankment junctions.	
DRAINS	None.	Some indication of calcium deposits on south abutment wingwall, but not very severe.
WATER PASSAGES	Not applicable.	
FOUNDATION	Dam appears to be founded on shale. Bedrock at toe of dam was not observed due to depth of water.	Bedding plane very steep 75-80 degrees downstream of dam, but closer to 45-60 degrees nearer dam toe.

CONCRETE/MASONRY DAMS

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SURFACE CRACKS CONCRETE SURFACES	Some surface deterioration of crest. Few rooster tails indicating some irregularities in concrete face, and some irregularities in flow over spillway approximately one third, and two thirds the height, indicating possible	Based on surface of water flowing over spillway, the deterioration of spillway concrete didn't appear too severe. This should be substantiated through observing dam under low flow conditions.
STRUCTURAL CRACKING	construction joints. North abutment wall shows rather severe deterioration, up to 8 inches deep or more. Under low flow conditions, deterioration up to 8 inches deep observed just below crest on upstream side about 150 ft. south of north abutment.	South abutment wall shows some surface spalling, not very significant.
VERTICAL & HORIZONTAL ALIGNMENT	No anomalies observed.	
MONOLITH JOINTS	None observed under rather high flow conditions. Inspection under low flow conditions revealed deterioration along monolith joints up to about 4 inches deep.	
CONSTRUCTION JOINTS	Surface of overflow water indicates possible construction joints at one-third and two-thirds height, and some deterioration at these joints.	Condition of joints should be observed under low flow conditions.
STAFF GAGE OF RECORDER	None observed.	

EMBANKMENT

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SURFACE CRACKS	Not applicable.	
UNUSUAL MOVEMENT OR CRACKING AT OR BEYOND THE TOE	Not applicable.	
SLOUGHING OR EROSION OF EMBANKMENT AND ABUTMENT SLOPES	Not applicable.	
VERTICAL AND HORIZONTAL ALINEMENT OF THE CREST	Not applicable.	
RIPRAP FAILURES	Not applicable.	

EMBANKMENT

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
JUNCTION OF EMBANKMENT AND ABUTMENT, SPILLWAY AND DAM	No signs of distress observed at junction of embankment and abutment.	At least a 30 ft. corewall extends from southern abutment into embankment.
ANY NOTICEABLE SEEPAGE	None observed.	
STAFF GAGE AND RECORDER	Not applicable.	
DRAINS	Not applicable.	

UNGATED SPILLWAY

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONCRETE WEIR	Ogee crested, concrete gravity. Condition as noted on sheets 2 and 3. Surface deterioration just below crest is more severe near pier near southern end.	All pipes that formerly accommodated flashboards were bent down to crest.
APPROACH CHANNEL	Nearly entire width of Battenkill.	Run of river dam.
DISCHARGE CHANNEL	Nearly entire width of Battenkill.	
BRIDGE AND PIERS	Pier near southern end shows significant deterioration, spalling of concrete surface especially near toe. Reinforcing bars protrude from concrete face about 6 inches. See Pictures.	Pier was formerly the southern abutment of the Ambursen shaped spillway.

GATED SPILLWAY

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONCRETE SILL	Not applicable.	
APPROACH CHANNEL	Not applicable.	
DISCHARGE CHANNEL	Not applicable.	
BRIDGE AND PIERS	Not applicable.	
GATES AND OPERATION EQUIPMENT	Not applicable.	

OUTLET WORKS

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CRACKING AND SPALLING OF CONCRETE SURFACES IN OUTLET CONDUIT	None observed.	
INTAKE STRUCTURE	Series of 9 gates inletting to mill plus 1 nearer to spillway section. Gate operators appear operable, although they haven't been used in a number of years. Impossible to ascertain condition of gates as they were well below water surface. Flow passing through conduits in mill (as observed through hole in walkway on upstream side of mill) probably due to seepage around and/or through the stop planks.	Bar racks upstream of gates. Mill no longer in operation. All gates operable during 5-16-80 visit. Gate openings to conduits passing through mill about 8ft. wide.
OUTLET STRUCTURE		Water intakes were used to provide mechanical power to grind pulp.
OUTLET CHANNEL	Batten Kill	
EMERGENCY GATE	48 inch waste pipe in north abutment.	

DOWNSTREAM CHANNEL

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONDITION (OBSTRUCTIONS, DEBRIS, ETC.)	Fairly clean, some trees near water's edge, a couple of islands downstream of dam.	
SLOPES	Fiarly shallow. Water may be backed up from downstream dam under high flows.	
APPROXIMATE NO. OF HOMES AND POPULATION	3 or 4 inhabited residences about 800 ft. downstream of dam that are about 11-12 ft. above stream. Approximately 12 inhabited residences between inspected dam and downstream dam that	
	may be affected under high flows. Hollingsworth & Vose Research Lab and Offices occupy a building near stream by downstream dam (about 7 ft. to 1st floor above downstream dam's spillway crest).	

INSTRUMENTATION

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
MONUMENTATION/SURVEYS	Not applicable.	
OBSERVATION WELLS	Not applicable.	
WEIRS	Not applicable.	
PIEZOMETERS	Not applicable.	
OTHER	Not applicable.	

RESERVOIR

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SLOPES	North bank fairly flat near stream increasing to fairly steep (5-15%) away from bank. South bank is very steep (to 40%).	
SEDIMENTATION	Not observable under high flow. When gates were opened, operators observed considerable more silt, etc. than last operation, indicating some silting of reservoir.	

CHECK LIST
ENGINEERING DATA
DESIGN, CONSTRUCTION, OPERATION
PHASE 1

NAME OF DAM Clarks Mills Dam

ID # NY 120

ITEM	REMARKS
AS-BUILT DRAWINGS	None available.
REGIONAL VICINITY MAP	USGS Map.
CONSTRUCTION HISTORY	Very limited - derived from construction applications and subsequent dam inspections from D.E.C. files.
TYPICAL SECTIONS OF DAM	Proposed Repair Plans dated February 1928. Original Plans for Ambursen section and mill dated 1904.
OUTLETS - PLAN - DETAILS - CONSTRAINTS - DISCHARGE RATINGS	As per 1904 and 1928 plans.
RAINFALL/RESERVOIR RECORDS	None available.

ITEM	REMARKS
DESIGN REPORTS	None available.
GEOLOGY REPORTS	None available.
DESIGN COMPUTATIONS HYDROLOGY & HYDRAULICS DAM STABILITY SEEPAGE STUDIES	None available.
MATERIALS INVESTIGATIONS BORING RECORDS LABORATORY FIELD	None available.
POST-CONSTRUCTION SURVEYS OF DAM	None available.
BORROW SOURCES	Not applicable.

ITEM	REMARKS
MONITORING SYSTEMS	None.
MODIFICATIONS	As per 1928 Plans.
HIGH POOL RECORDS	Not available.
POST CONSTRUCTION ENGINEERING STUDIES AND REPORTS	None available.
PRIOR ACCIDENTS OR FAILURE OF DAM DESCRIPTION REPORTS	None known.
MAINTENANCE OPERATION. RECORDS	Facilities no longer in use.

ITEM	REMARKS
SPILLWAY PLAN SECTIONS DETAILS	As per 1904 and 1928 Plans.
OPERATING EQUIPMENT PLANS & DETAILS	As per 1904 Plans.

CHECK LIST
HYDROLOGIC & HYDRAULIC
ENGINEERING DATA

DRAINAGE AREA CHARACTERISTICS: Battenkill

ELEVATION TOP NORMAL POOL (STORAGE CAPACITY): 874 ac.-ft. @ elev. 134

ELEVATION TOP FLOOD CONTROL POOL (STORAGE CAPACITY): 1498 ac.-ft. @ elev. 141 (Top of Dam)

ELEVATION MAXIMUM DESIGN POOL: Not available

ELEVATION TOP DAM: 141

CREST:

a. Elevation 134
b. Type Ambursen (north), Ogee (south)
c. Width Not applicable
d. Length 250 ft. north, 90 ft. south
e. Location Spillover Not applicable
f. Number and Type of Gates None

OUTLET WORKS:

a. Type Waste Pipe plus 5 conduits through old mill
b. Location Right abutment
c. Entrance Inverts No data available
d. Exit Inverts No data available
e. Emergency Draindown Facilities 48 inch pipe @ elev. 113 (invert)

HYDROMETEOROLOGICAL GAGES:

a. Type None
b. Location --
c. Records --

MAXIMUM NON-DAMAGING DISCHARGE: Unknown

APPENDIX B

PREVIOUS INSPECTION REPORTS/RELEVANT CORRESPONDENCE

Acc. 332

NOTICE: After filling out one of these forms as completely as possible for each dam in your district, return it at once to the Conservation Commission, Albany.

STATE OF NEW YORK

CONSERVATION COMMISSION

ALBANY.

V 264 UN

DAM REPORT

....., 191.....
(Date)

CONSERVATION COMMISSION,

DIVISION OF INLAND WATERS.

GENTLEMEN:

I have the honor to make the following report in relation to the structure known as the Cooks Mill Dam.

This dam is situated upon the Batten Kill
(Give name of stream)
in the Town of ?, Washington County,
about ½ mile from the Village or City of Cooks Mills
(State distance)
The distance down stream from the dam, to the Hudson V R Railroad bridge,
(Up or down) (Give name of nearest important stream or to a bridge)
is about ½ mile.
(State distance)

The dam is now owned by American Woolen Co Schuylerville N.Y.
(Give name and address in full)
and was built in or about the year ?, and was extensively repaired or reconstructed during the year.....

As it now stands, the spillway portion of this dam is built of ?
(State whether of masonry, concrete or timber)
and the other portions are built of .....
(State whether of masonry, concrete, earth or timber with or without rock fill)

As nearly as I can learn, the character of the foundation bed under the spillway portion of the dam is .....and under the remaining portions such foundation bed is .....

The total length of this dam is 26 feet. The spillway or waste-weir portion, is about 16 feet long, and the crest of the spillway is about 6 feet below the top of the dam.

The number, size and location of discharge pipes, waste pipes or gates which may be used for drawing off the water from behind the dam, are as follows: nine headgates

At the time of this inspection the water level above the dam was ft. 4 in. below / above the crest of the spillway.

(State briefly, in the space below, whether, in your judgment, this dam is in good condition, or bad condition, describing particularly any leaks or cracks which you may have observed.)

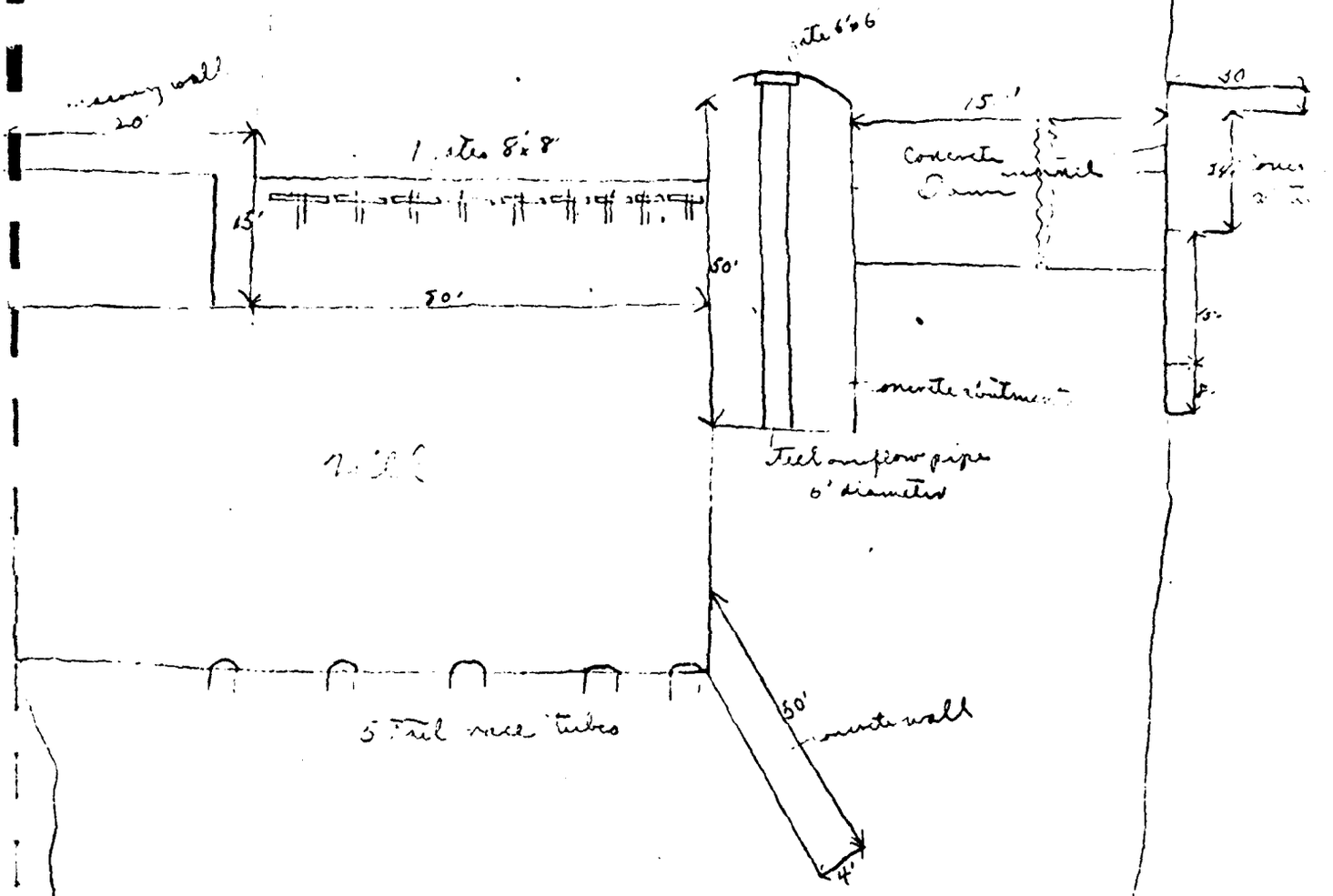
3 flashboards. Dam is in excellent condition

Reported by [illegible]
(Signature)

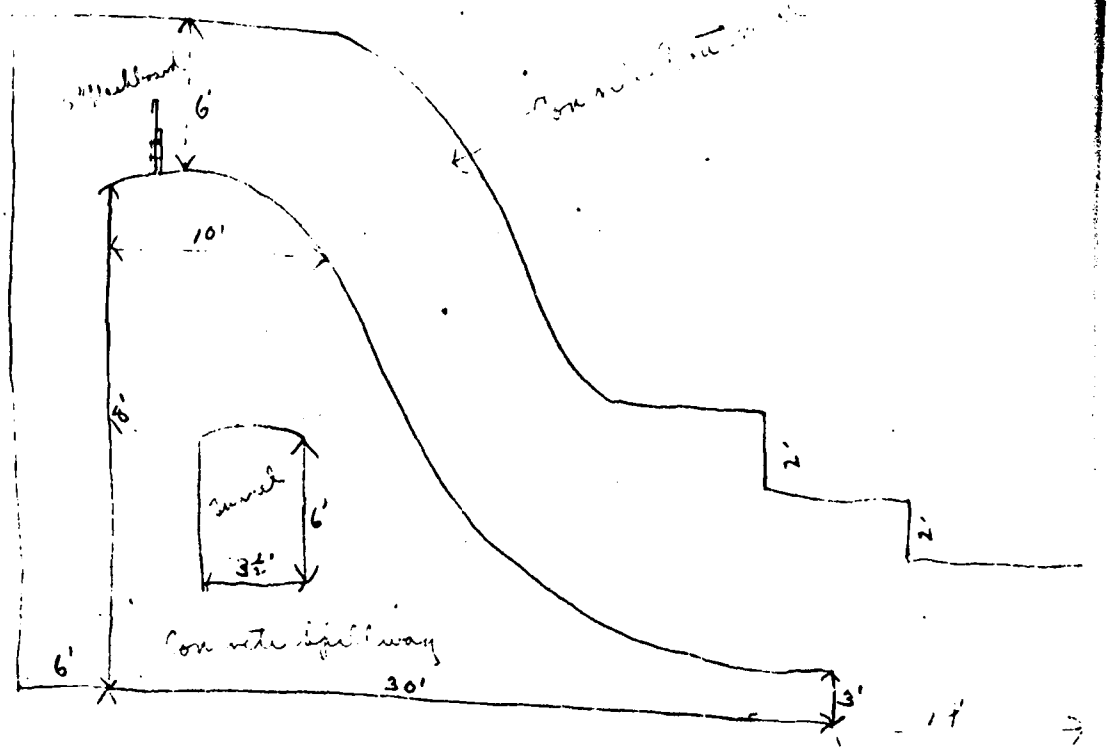
[illegible]
(Address—Street and number, P. O. Box or R. F. D. route)

[illegible]
(Name of city)

(In the space below, make a third sketch showing the general plan of the dam, and its approximate position in relation to buildings or other conspicuous objects in the vicinity.)



(In the space below, make one sketch showing the form and dimensions of a cross section through the spillway or waste-weir of this dam, and a second sketch showing the same information for a cross section through the other portion of the dam. Show particularly the greatest height of the dam above the stream bed, its thickness at the top, and thickness at the bottom, as nearly as you can learn.)



The above information is correct to the best of my knowledge and belief.

Thompsons Ky.
(Address of signer)

March 10-78
(Date)

American Coal Sand Co.
per Glenn Whitfield
(A person signing for owner should indicate his title or authority)

6-8-27-300 (6-7068)

STATE OF NEW YORK

DEPARTMENT OF PUBLIC WORKS
DIVISION OF ENGINEERING
ALBANY

Received Mar. 16, 1928 Dam No. 264 (old number)
Disposition Approved Apr. 3, 1928 Watershed Upper Hudson
Foundation inspected
Structure inspected

Application for the Construction or Reconstruction of a Dam

Application is hereby made to the Superintendent of Public Works, Albany, N. Y., in compliance with the provisions of Chapter LXV of the Consolidated Laws and Chapter 647, Laws of 1911, Section 22 as amended and amendatory laws for the approval of specifications and detailed drawings, marked PROPOSED REPAIRS TO DAM ON BATTENKILL CREEK herewith submitted for the {~~construction~~ / reconstruction} of a dam located as stated below. All provisions of law will be complied with in the erection of the proposed dam. It is intended to complete the work covered by the application about AUG 1928 (Date)

1. The dam will be on BATTENKILL flowing into HUDSON in the town of GREENWICH - EASTON, County of WASHINGTON and 2 MILES FROM SCUYLERVILLE (Give exact distance and direction from a well-known bridge, dam, village main cross-roads or mouth of a stream)

2. The name and address of the owner is AMERICAN WOOD BOARD CO

3. The dam will be used for POWER

4. Will any part of the dam be built upon or its pond flood any State lands? NO

5. The watershed at the proposed dam draining into the pond to be formed thereby is 440 square miles.

6. The proposed dam will have a pond area at the spillcrest elevation of 15 acres and will impound 4 MILLION cubic feet of water.

7. The lowest part of the natural shore of the pond is 7 feet vertically above the spillcrest,; and everywhere else the shore will be at least 25 feet above the spillcrest.

8. The maximum known flow of the stream at the dam site was 23000 cubic feet per second on NOV. 5-29 (Date)

9. State if any damage to life or to any buildings, roads or other property could be caused by any possible failure of the proposed dam NO

10. The natural material of the bedon which the proposed dam will rest is (clay, sand, gravel, boulders, granite, shale, slate, limestone, etc.) HUDSON RIVER SHALE

PRESENT ABUTMENT.

11. The material of the right bank, in the direction with the current, is ..... ; at the spillcrest elevation this material has a top slope of ..... inches vertical to a foot horizontal on the center line of the dam, a vertical thickness at this elevation of ..... feet, and the top surface extends for a vertical height of ..... feet above the spillcrest.

12. The material of the left bank is CLAY ; has a top slope of 1 ON ~~inches~~ to a foot horizontal, a ~~thickness~~ of ..... feet, and a height of 100 feet

13. State the character of the bed and the banks in respect to the hardness, perviousness, water bearing, effect of exposure to air and to water, uniformity, etc.....

RIGHT BANK. VERY IMPERVIOUS

14. If the bed is in layers, are the layers horizontal or inclined? HORIZONTAL If inclined what is the direction of the horizontal outcropping relative to the axis of the main dam and the inclination and direction of the layers in a plane perpendicular to the horizontal outcropping.....

15. What is the thickness of the layers?.....

16. Are there any porous seams or fissures?.....

17. WASTES. The spillway of the above proposed dam will be 340 feet long in the clear; the waters will be held at the right end by a CONC. DAM the top of which will be 7 feet above the spillcrest, and have a top width of EXISTING STRUCTURE feet, and at the left end by a CONC. DAM AND EARTH EMB. WITH ONE CORE the top of which will be 7 feet above the spillcrest, and have a top width of 17 feet.

18. There will be also for flood discharge a pipe..... inches inside diameter and the bottom will be..... feet below the spillcrest, a sluice or gate..... feet wide in the clear by ..... feet high, and the bottom will be..... feet below the spillcrest.

19. APRON. Below the proposed dam there will be an EXISTING ROCK apron..... feet long across the stream, ... feet wide and..... feet thick. The downstream side of the apron will have a thickness of..... feet for a width of..... feet.

20. PLANS. Each application for a permit of a dam over 12 feet in height must be accompanied by a location map and complete working drawings in triplicate of the proposed structure, one set of which will be returned if they are approved. Each drawing should have a title giving the parts shown, the name of the town and county in which the dam site is located, and the name of the owner and of the engineer.

The location map (U. S. Geological Quadrangle or other map) should show the exact location of the proposed dam, of buildings below the dam which might be damaged by any failure of the dam; of roads adjacent to or crossing the stream below the dam, giving the lowest elevation of the roadway above the stream bed and giving the shape,

the height and the width of stream openings; and of any embankments or steep slopes that any flood could pass over. Also indicate the character and use made of the ground below the dam.

The complete working drawings should give all the dimensions necessary for the calculations of the stability of the structure, and all the information asked for below under "Sketches." There may be attached to the application any written reports, calculations, investigations or opinions that may aid in showing the data and method used by the designer. State the assumed ice and uplift pressures and the conditions on which based.

21. SKETCHES. For small and unimportant structures, if plans have not been made, on the back of this application make a sketch to scale for each different cross-section at the highest point; giving the height and the depth from the surface of the foundation, the bottom width, the top width (for a concrete or masonry spill at 18 inches below the crest), the elevation of the top in reference to the spillcrest, the length of the section, and the material of which the section is to be constructed; on the spillway section show a cross section of the apron, giving its width, thickness and material, and show the abutment or wash wall at the end of the spillway, giving its heights and thickness. Mark each section with a capital letter. Also sketch a plan; show the above sections by their top lines, giving the mark and the length of each; the openings by their horizontal dimensions; the abutments by their top width and top lengths from the upstream face of the spillcrest; and outline the apron. Also sketch an elevation of each end of the dam with a cross section of the banks, giving the depth and width excavated into the banks.

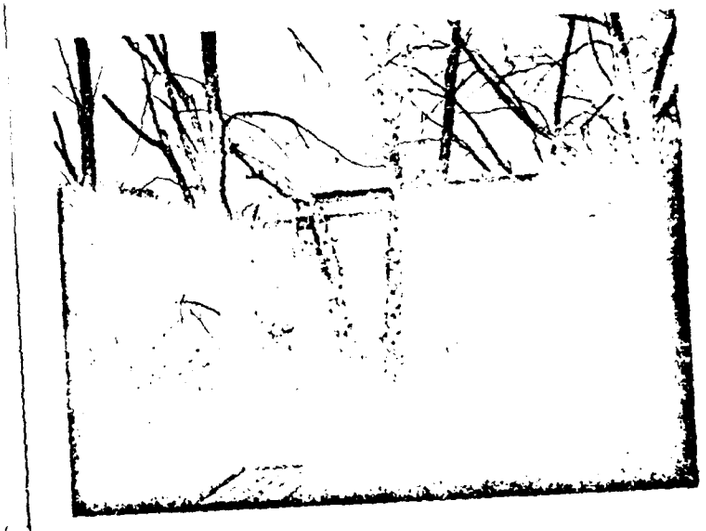
22. ELEVATIONS. Also give the elevations, if possible from the Mean Sea Level, of at least two permanent Bench Marks; of the spillcrest for any existing dam on the proposed dam site, at the middle and at the ends of the spill; of the spillcrest for the above proposed dam; and of the spillcrest of any adjacent dams.

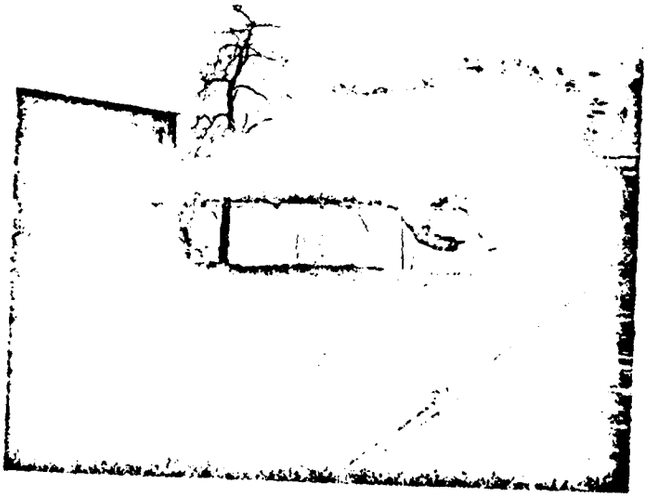
23. SAMPLES. When so instructed, send samples of the materials to be used in the construction of the proposed dam, using shipping tags which will be furnished. For sand, one-half a cubic foot is desired (exclusive of any stone over $\frac{1}{4}$ inch in size mixed therewith); for cement, three pints; and for the natural bed, twenty cubic inches if of ledge and one-half a cubic foot if of soil.

24. INSPECTION. State how inspection is to be provided for during construction. . .....

.....

25. WATER SUPPLY. Are the waters impounded by the above dam to be used for a public water supply?.....
Has an application under the provisions of Article IX of the Conservation Law for such use been made to the Water Control Commission, Albany, N. Y.?





DAm # 02-264
DATE NOV. 5, 1970

F027542

DAm # 02-264
DATE NOV. 5, 1970

F027542

RB	CTY	YR AP.	DAM NO.	INS. DATE	USE	TYPE
42	58	04	00026 4	05 11 70	003	8

AS BUILT INFORMATION

[1] Location of Sp'way and outlet	[1] Elevations
[1] Size of Sp'way and Outlet	[1] Geometry of Non-overflow section

[1] GENERAL CONDITION OF NON-OVERFLOW SECTION

[1] Settlement	[1] Cracks	[1] Deflections
[1] Joints	[2] Surface of Concrete	[1] Leakage
[1] Undermining	[1] Settlement of Embankment	[1] Crest of Dam
[1] Downstream Slope	[1] Upstream Slope	[1] Toe of Slope

[1] GENERAL COND. OF SP'WAY AND OUTLET WORKS

[1] Auxiliary Spillway	[1] Service or Concrete Sp'way	[1] Stilling Basin
[2] Joints	[2] Surface of Concrete	[1] Spillway Toe
[2] Mechanical Equipment	[1] Plunge Pool	[2] Drain

[1] Maintenance	[C] Hazard Class
[3] Evaluation	[34] Inspector

COMMENTS:

Dam in good condition

[illegible] QUALITY [illegible]
[illegible] TO EBC.

1. River Basin - Nos. 1-23 on Compilation Sheets
2. County - Nos. 1-62 Alphabetically
3. Year Approved -
4. Inspection Date - Month, Day, Year
5. Apparent use -
   1. Fish & Wildlife Management
   2. Recreation
   3. Water Supply
   4. Power
   5. Farm
   6. No Apparent Use
6. Type -
   1. Earth with Aux. Service Spillway
   2. Earth with Single Conc. Spillway
   3. Earth with Single non-conc. Spillway
   4. Concrete
   5. Other
7. As-Built Inspection - Built substantially according to approved plans and specifications

Location of Spillway and Outlet Works

1. Appears to meet originally approved plans and specifications.
2. Not built according to plans and specifications and location appears to be detrimental to structure.
3. Not built according to plans and specifications but location does not appear to be detrimental to structure.

Elevations

1. Generally in accordance to approved plans and specifications as determined from visual inspection and use of hand level.
2. Not built according to plans and specifications and elevation changes appear to be detrimental to structure.
3. Not built according to plans and specifications but elevation changes do not appear to be detrimental to structure.

Size of Spillway and Outlet Works

1. Appears to meet originally approved plans and specifications as determined by field measurements using tape measure.
2. Not built according to plans and specifications and changes appear detrimental to structure.
3. Not built according to plans and specifications but changes do not appear detrimental to structure.

Geometry of Non-overflow Structures

1. Generally in accordance to originally approved plans and specifications as determined from visual inspection and use of hand level and tape measure.
2. Not built according to plans and specifications and changes appear detrimental to structure.
3. Not built according to plans and specifications but changes do not appear detrimental to structure.

General Conditions of Non-Overflow Section

1. Adequate - No apparent repairs needed or minor repairs which can be covered by periodic maintenance.
2. Inadequate - Items in need of major repair.

(ITEMS) For boxes listed on condition under non-overflow section.

1. Satisfactory.
2. Can be covered by periodic maintenance.
3. Unsatisfactory - Above and beyond normal maintenance.

1. Adequate - No apparent repairs needed or minor repairs which can be covered by periodic maintenance.
2. Inadequate - Items in need of major repair.

Items) For boxes listed conditions listed under spillway and outlet works.
1. Satisfactory.
2. Can be covered by periodic maintenance.
3. Unsatisfactory - Above and beyond normal maintenance.
4. Dam does not contain this feature.

Maintenance

1. Evidence of periodic maintenance being performed.
2. No evidence of periodic maintenance.
3. No longer a dam or dam no longer in use.

(S.C.S.) Hazard Classification Downstream

CLASSIFICATI
CORPS ENGRS
(III)
(II)
(I)

1. (A) Damage to agriculture and county roads.
2. (B) Damage to private and/or public property.
3. (C) Loss of life and/or property.

Evaluation - Based on Judgment and Classification in Box Nos.

Evaluation for Unsafe Dam

1. Unsafe - Repairable.
2. Unsafe - Not Repairable.
3. Insufficient evidence to declare unsafe.

RIVER BASINS

(1) LOWER HUDSON
(2) UPPER HUDSON
(3) MOHAWK
(4) LAKE CHAMPLAIN
(5) DELAWARE
(6) SUSQUEHANNA
(7) CHEMUNG
(8) OSWEGO
(9) GENESEE
(10) ALLEGHENY
(11) LAKE ERIE
(12) WESTERN LAKE ONTARIO
(13) CENTRAL LAKE ONTARIO
(14) EASTERN LAKE ONTARIO
(15) SALMON RIVER
(16) BLACK RIVER
(17) WEST ST. LAWRENCE
(18) EAST ST. LAWRENCE
(19) RACQUETTE RIVER
(20) ST. REGIS RIVER
(21) HOUSATONIC
(22) LONG ISLAND
(23) OSWEGATCHIE
(24) GRASSE

COUNTIES

STATE NAME: NEW YORK

STATE ABBREVIATION: NY

STATE CODE: 36

CODE	COUNTY NAME
1	ALBANY
2	ALLEGANY
3	BRONX
4	BROOME
5	CATTARAUGUS
6	CAYUGA
7	CHAUTAUQUA
8	CHEMUNG
9	CHENANGO
10	CLINTON
11	COLUMBIA
12	CORTLAND
13	DELAWARE
14	DUTCHESS
15	ERIE
16	ESSEX
17	FRANKLIN
18	FULTON
19	GENESEE
20	GREENE
21	HAMILTON
22	HERKIMER
23	JEFFERSON
24	KINGS
25	LEWIS
26	LIVINGSTON
27	MADISON
28	MONROE
29	MONTGOMERY
30	NASSAU
31	NEW YORK
32	NIAGARA
33	ONEIDA
34	ONONDAGA
35	ONTARIO
36	ORANGE
37	ORLEANS
38	OSWEGO
39	OTSEGO
40	PUTNAM
41	QUEENS
42	RENSSELAER
43	RICHMOND
44	ROCKLAND
45	ST LAWRENCE
46	SARATOGA
47	SCHENECTADY
48	SCHOHARIE
49	SCHUYLER
50	SENECA
51	STEUBEN
52	SUFFOLK
53	SULLIVAN
54	TIOGA
55	TOMPKINS
56	ULSTER
57	WARREN
58	WASHINGTON
59	WAYNE
60	WESTCHESTER
61	WYOMING
62	YATES

Pete
~~Bob~~ Lacedaria
Clarks Mills

Bob McDow · 885-8931

~~Hos Engineer~~

· SP-558-05-0055-78

DAM No. 259

Called on July 11, 1979 He wants to raise the crest of the ogee section by 1 foot. This will bring the pool up 1 foot. I told him the only way he could do that was to resubmit ~~for~~ for a new permit. I told him to contact Stan Zecallo.

APPENDIX C

HYDROLOGIC AND HYDRAULIC COMPUTATIONS

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TEL 315•797•5800

DESIGN BRIEF

PROJECT NAME _____ DATE _____

SUBJECT Dam Inspections PROJECT NO. _____

Clarks Mills DRAWN BY _____

Depth-Area-Duration Relationship

$A = 441\ mi^2$

Ref: HMR #33

Index Precipitation = 18.5" for 200 mi^2, 24 hr.

Duration	% of 24hr., 200 mi^2	Depth
6 hr	72%	13.3"
12	87	16.1
24	98	18.1
48	104	19.2

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DESIGN BRIEF

PROJECT NAME N.Y.S. Dam Inspections DATE

SUBJECT Clarks Mills PROJECT NO.

DRAWN BY

Sub-Area 56.1

Hydrograph Parameters based on "Upper Hudson & Mohawk River Basins Hydrologic Flood Routing Models" - Corps of Engineers

$(T_c + R) = 7.52 A^{0.215} * St^{0.425}$ Eqn. 5.3a

$R = 3.30 A^{0.155} * St^{0.775}$ Eqn. 5.3b

Good for $15 \leq A \leq 1000$ mi²
$1.05 \leq St \leq 4.10$

A = drainage area, mi²
St = surface area of lakes and reservoirs as percent of total drainage area, % + 1.0

T_c, R = Clark unit hydrograph parameters, hrs

$A = 46.9$ mi²
$St = 1.15$

$R = 3.3 (46.9)^{0.155} * (1.15)^{0.775} = 6.68$

$(T_c + R) = 7.52 (46.9)^{0.215} * (1.15)^{0.425} = 18.25$

$T_c = 11.6$

Initial Flow, STRTQ = 62 cfs for A = 47 mi² Fig. 5.1

Recession Flow, QRCSN = 460 cfs for A = 47 Fig. 5.3

RTIOR = 1.3

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DESIGN BRIEF

PROJECT NAME _____ DATE _____

SUBJECT Clarks Mills PROJECT NO. _____

DRAWN BY _____

Muskingum's K

$$K_r = \frac{L_r}{V_r} * \frac{1}{3600}$$ Eqn 5.6

K_r = Muskingum K for reach r, hrs
L_r = reach length, ft
V_r = est. avg. travel velocity for reach, r (ft/sec)

$$V_r = \left(S_r/S_b\right)^{1/2} * V_b$$ Eqn. 5.7

S_b = Slope of "base" reach (ft/mi)
S_r = Slope of reach (ft/mi)
V_b = avg. travel vel. for "base" reach (ft/sec)

S_b = 10.56 ft/mi
V_b = 3.8 fps

L_r = 11.25 mi = 59,400'
S_r = 23.73 ft/mi

$$V_r = \left(\frac{23.73}{10.56}\right)^{1/2} * 3.8 = 5.7 \text{ fps}$$

$$K_r = \frac{59400}{5.7} * \frac{1}{3600} = 2.9 \text{ hrs.}$$ for reach from Battenville to Clarks Mills

X = 0.3 (steep)

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DESIGN BRIEF

PROJECT NAME _____ DATE _____

SUBJECT Clarks Mills Dam PROJECT NO. _____

Spillway Stage-Discharge Curve DRAWN BY JAG

$Q = C L H^{3/2}$

Southern spillway section $L = 90'$

C determined from Fig. 14-4 Chow- "Open-Channel Hydraulics"

$H_d \sim 4'$ based on spillway dimensions

$C_d = 4.03$

$h/H_d > 1.33$

Elev.	H	H/H_d	C/C_d	C	Q (cfs)
134	0				0
135	1	0.25	.815	3.28	295
136	2	0.5	.9	3.63	924
137	3	0.75	.96	3.87	1810
138	4	1	1.0	4.03	2900
139	5	1.25	1.02	4.11	4135
140	6	1.5	1.03	4.15	5490
141	7	1.75			6915
142	8	2			8450
143	9	2.25			10085
144	10	2.5			11810
146	12	3.0			15525
148	14	3.5			19565
150	16	4			23905
152	18	4.5			28525
154	20	5	1.03	4.15	33405
156	22				38540
158	24				43915
160	26			4.15	49515

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DESIGN BRIEF

PROJECT NAME _____ DATE _____

SUBJECT Clarks Mills Dam PROJECT NO _____

DRAWN BY JAG

Northern Spillway portion
C estimated from spillway dimensions and from King & Brater - "Handbook of Hydraulics" - for a similar section
L = 250' Ambursen-type structure

Elev.	H	C	Q (cfs)	Total Spillway Discharge, cfs
134	0	—	0	0
135	1	3.25	813	1110
136	2	3.28	2319	3245
137	3	3.3	4287	6100
138	4	3.37	6740	9640
139	5	3.45	9645	13780
140	6	3.5	12860	18350
141	7	3.55	16435	23350
142	8	3.6	20365	28815
143	9	3.65	24640	34725
144	10		28855	40665
146	12		37930	53455
148	14		47800	67365
150	16		58400	82305
152	18		69685	98210
154	20	3.65	81615	115,020
156	22		94160	132,700
158	24		107285	151,200
160	26	3.65	120975	170,490

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DESIGN BRIEF

PROJECT NAME NEW YORK STATE DAM INSPECTION DATE 5 14 80

SUBJECT CLARK'S MILLS DAM PROJECT NO. 2399

STAGE - STORAGE DRAWN BY JPS

	STAGE	AREA (Ac)	VOL (Ac-Ft)	Σ VOL (Ac-Ft)
	113	0		
	114	3.97	1.98	1.98
	115	7.93	5.95	7.94
	116	11.90	9.92	17.85
	117	15.86	13.88	31.73
	118	19.83	17.85	49.58
	119	23.79	21.81	71.39
	120	27.76	25.78	97.17
	121	31.72	29.74	126.91
	122	35.69	33.71	160.61
	123	39.56	37.69	198.30
	124	43.62	41.59	239.89
	125	47.59	45.61	285.50
	126	51.55	49.57	335.07
	127	55.52	53.54	388.61
	128	59.48	57.50	446.11
	129	63.45	61.47	507.58
	130	67.41	65.43	573.01
	131	71.38	69.40	642.41
	132	75.34	73.36	715.77
	133	79.31	77.33	793.10
CREST	134	83.27	81.29	874.39
	135	86.23	84.75	959.14
	136	89.18	87.71	1014.85
	137	92.14	90.67	1105.52
	138	95.10	93.62	1199.14
	139	98.05	96.58	1295.72
	140	101.01	99.53	1395.25
	141	103.88	102.45	1497.70
	142	106.75	105.32	1603.02
	143	109.62	108.19	1711.21
	144	112.49	111.06	1822.27

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DESIGN BRIEF

PROJECT NAME NEW YORK STATE DAM INSPECTION DATE 5 14 82

SUBJECT CLARK'S MILLS DAM PROJECT NO. 2397

STAGE STORAGE DRAWN BY JPG

STAGE	AREA (AC)	VOL (AC-FT)	Σ VOL (AC-FT)
		111.06	1822.27
144	112.49	112.92	1935.19
145	113.35	113.78	2048.97
146	114.21	114.64	2163.61
147	115.07	115.50	2279.11
148	115.93	116.36	2395.47
149	116.79	117.22	2512.69
150	117.65	118.08	2630.77
151	118.51	118.94	2749.71
152	119.37	119.80	2869.51
153	120.23	120.66	2990.17
154	121.09	121.52	3111.69
155	121.95	122.38	3234.07
156	122.81	123.24	3357.31
157	123.67	124.10	3481.41
158	124.53	124.96	3606.37
159	125.39	125.82	3732.19
160	126.26		

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DESIGN BRIEF

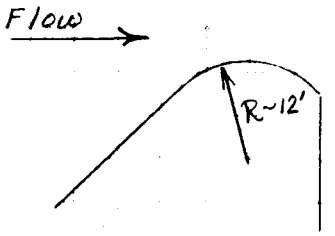
PROJECT NAME _____ DATE _____

SUBJECT Locks Mills PROJECT NO _____

DRAWN BY _____

Stage - Discharge for Dam U/S of Proposed Dam (I.E. C. Research 106)

Spillway Crest @ Elev. 101.0 Length = 300'
Abutments @ ~107
Also 2 gates 17' wide



Elev.	H	H/R	C	$Q = CLH^{3/2}$
101	0	—	—	0 cfs
103	2	.17	3.1	2630
105	4	.33	3.28	7870
107	6	.5	3.3	14550
109	8	.67	3.35	22740
111	10	.83	3.42	32445
113	12	1	3.52	43900
115	14	1.17	3.58	56260
117	16	1.33	3.6	69120
119	18	1.5	3.65	83620
121	20	1.67	↓	97940
123	22	1.83	↓	112990
125	24	2	↓	128,750
127	26	2.17	↓	145,170
129	28	2.33	↓	162,240
131	30	2.5	↓	179,930

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DESIGN BRIEF

PROJECT NAME N.Y.S. Dam Inspections - 126 DATE

SUBJECT Clear Mills Dam PROJECT NO

Reservoir Drain Discharge Rating DRAWN BY

48" Ø Waste Tube, invert elev. ~113
~35' long

Inlet control & full pipe relations utilized to determine rating condition by Figs. B-8 & B-10 respectively "Design of Small Dams"

Elev.	H	H/D	Q_I	$H_f = H - .85D$	Q_f	Q
120	7	1.75	130			130 cfs
125	12	3.0	195	8.6	230	195
130	17	4.25	235	13.6	290	235
134	21	5.25	275	17.6	320	275

```
(0001)   A1                 CLARKS MILLS DAM
(0002)   A2                 PMF OVERTOPPING ANALYSIS
(0003)   A3                 MODEL DERIVED FROM UPPER HUDSON C OF E MODEL
(0004)   B       9      1       0       0       0       0       0       0       4
(0005)   B1      5
(0006)   J       1      7       1
(0007)   J1    0.2    0.3     0.4     0.5     0.6     0.8     1.0
(0008)   K       0     54       0       0       0       0       1
(0009)   K1          HYDROGRAPH AT ARLINGTON, VT
(0010)   M       1      0     152       0     440       0       0       0       1
(0011)   P       0   18.5      72      87      98     104
(0012)   T       0      0       0       0       0       0    1.25   0.075
(0013)   V   15.41   7.91
(0014)   X     250   1950     1.3
(0015)   K       1   5455       0       0       0       0       1
(0016)   K1          ROUTE TO 1055 BATTENVILLE, NY
(0017)   Y       0      0       0       0       1
(0018)   Y1      7      0       0    1.42      .3
(0019)   K       0     55       0       0       0       0       1
(0020)   K1          SUB-AREA RUN-OFF
(0021)   M       1      0     242       0     440       0       0       0       1
(0022)   P       0   18.5      72      87      98     104
(0023)   T       0      0       0       0       0       0     1.0   0.075
(0024)   V   20.07  14.59
(0025)   X     440   3400     1.3
(0026)   K       2     55       0       0       0       0       1
(0027)   K1          COMBINE 2 HYDROGRAPHS AT BATTENVILLE, NY
(0028)   K       1   5556       0       0       0       0       1
(0029)   K1          ROUTE TO CLARKS MILLS DAM
(0030)   Y       0      0       0       0       1
(0031)   Y1      1      0       0     2.9      .3
(0032)   K       0   56.1       0       0       0       0       1
(0033)   K1          RUN-OFF SUBAREA 56.1
(0034)   M       1      0    46.9       0     440       0       0       0       1
(0035)   P       0   18.5      72      87      98     104
(0036)   T       0      0       0       0       0       0     1.0   0.075
(0037)   V    11.6    6.7
(0038)   X      62    460     1.3
```

```
(0039)   K       2     56.1        0        0        0        0        1
(0040)   K1        COMBINE 2 HYDROGRAPHS AT CLARKS MILLS DAM
(0041)   K       1     56.1        0        0        0        0        1
(0042)   K1        ROUTE OVER CLARKS MILLS DAM
(0043)   Y       0        0        0        1        1
(0044)   Y1      1        0        0        0        0        0   -134.       -1
(0045)   Y4    134      135      136      137      138      139      140      141      142      143
(0046)   Y4    144      146      148      150      152      154      156      158      160
(0047)   Y5      0     1110     3245     6100     9640    13760    18350    23350    28815    34725
(0048)   Y5  40665    53455    67365    82305    98210   115020   132700   151200   170490
(0049)   $S      .     17.8     71.4    160.6    285.5      446      642      874     1106     1296
(0050)   $S   1498     1822     2049     2279     2513     2750     2990     3234     3481     3732
(0051)   $E    113      116      119      122      125      128      131      134      137      139
(0052)   $E    141      144      146      148      150      152      154      156      158      160
(0053)   $$   134.
(0054)   $D   141.     2.64      1.5       55
(0055)   K       1     56.2        0        0        0        0        1
(0056)   K1        ROUTE  TO  DOWNSTREAM HOUSES
(0057)   Y       0        0        0        1        1
(0058)   Y1      1        0        0        0        0        0       -1
(0059)   Y6   .060    0.040     .060      109      130      600     .007
(0060)   Y7    500      130     1150      120     1270      118     1290      109     1650      109
(0061)   Y7   1670      118     1800      120     1860      130
(0062)   K       1     56.3        0        0        0        0        1
(0063)   K1        ROUTE  OVER DOWNSTREAM DAM (BY RESARCH LAB)
(0064)   Y       0        0        0        1        1
(0065)   Y1      1        0        0        0        0        0   -101.       -1
(0066)   Y4    101      103      105      107      109      111      113      115      117      119
(0067)   Y4    121      123      125      127      129      131
(0068)   Y5      0     2630     7870    14550    22740    32445    43900    56260    69120    83620
(0069)   Y5  97940   112990   128750   145170   162240   179930
(0070)   $S      0      130      323      757
(0071)   $E    101      105      110      120
(0072)   $$   101.
(0073)   $D   107.     2.64      1.5      100
(0074)   K     99
(0075)   A
(0076)   A
```

PREVIEW OF SEQUENCE OF STREAM NETWORK CALCULATIONS

RUNOFF HYDROGRAPH AT	54
ROUTE HYDROGRAPH TO	5455
RUNOFF HYDROGRAPH AT	55
COMBINE 2 HYDROGRAPHS AT	55
ROUTE HYDROGRAPH TO	5556
RUNOFF HYDROGRAPH AT	56.1
COMBINE 2 HYDROGRAPHS AT	56.1
ROUTE HYDROGRAPH TO	56.1
ROUTE HYDROGRAPH TO	56.2
ROUTE HYDROGRAPH TO	56.3

END OF NETWORK

```
**********************************
FLOOD HYDROGRAPH PACKAGE (HEC-1)
DAM SAFETY VERSION      JULY 1978
  LAST MODIFICATION  26 FEB 79
**********************************

RUN  DATE?THU, MAY 29 1980
     TIME?11:02:23
```

CLARKS MILLS DAM
PMF OVERTOPPING ANALYSIS
MODEL DERIVED FROM UPPER HUDSON C OF E MODEL

JOB SPECIFICATION

NQ	NHR	NMIN	IDAY	IHR	IMIN	METRC	IPLT	IPRT	NSTAN
90	1	0	0	0	0	0	0	4	0

JOPER	NWT	LROPT	TRACE
5	0	0	0

MULTI-PLAN ANALYSES TO BE PERFORMED
NPLAN= 1 NRTIO= 7 LRTIO= 1

RTIOS=	0.20	0.30	0.40	0.50	0.60	0.80	1.00

********** ********** ********** ********** **********

SUB-AREA RUNOFF COMPUTATION

HYDROGRAPH AT ARLINGTON, VT

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
54	0	0	0	0	0	1	0	0

HYDROGRAPH DATA

IHYDG	IUHG	TAREA	SNAP	TRSDA	TRSPC	RATIO	ISNOW	ISAME	LOCAL
1	0	152.00	0.00	440.00	0.00	0.000	0	1	0

PRECIP DATA

SPFE	PMS	R6	R12	R24	R48	R72	R96
0.00	18.50	72.00	87.00	98.00	104.00	0.00	0.00

TRSPC COMPUTED BY THE PROGRAM IS 0.898

LOSS DATA

LROPT	STRKR	DLTKR	RTIOL	ERAIN	STRKS	RTIOK	STRTL	CNSTL	ALSMX	RTIMP
0	0.00	0.00	1.00	0.00	0.00	1.00	1.25	0.07	0.00	0.0

UNIT HYDROGRAPH DATA
TC= 15.41 R= 7.91 NTA= 0

RECESSION DATA
STRTQ= 250.00 QRCSN= 1950.00 RTIOR= 1.50

UNIT HYDROGRAPH 51 END-OF-PERIOD ORDINATES, LAG= 12.66 HOURS, CP= 0.74 VOL= 1.00

136.	505.	1017.	1601.	2226.	2874.	3532.	4190.	4785.	5250.
5575.	5769.	5835.	5771.	5559.	5126.	4552.	4011.	3534.	3114.
2744.	2417.	2130.	1877.	1654.	1457.	1284.	1131.	997.	878.
774.	682.	601.	529.	466.	411.	362.	319.	281.	248.
218.	192.	169.	149.	131.	116.	102.	90.	79.	70.
62.									

O MO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q	END-OF-PERIOD FLOW MO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q
									SUM	17.27	14.38	2.89	1415281.
										(439.)	(365.)	(74.)	(40076.26)

********** ********** ********** ********** **********

HYDROGRAPH ROUTING

ROUTE TO 1055 BATTENVILLE, NY

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
5455	1	0	0	0	0	1	0	0

ROUTING DATA

QLOSS	CLOSS	AVG	IRES	ISAME	IOPT	IPMP	LSTR
0.0	0.000	0.00	0	1	0	0	0

NSTPS	NSTDL	LAG	AMSKK	X	TSK	STORA	ISPRAT
7	0	0	1.420	0.300	0.000	0.	0

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SUB-AREA RUNOFF COMPUTATION

SUB-AREA RUN-OFF

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
55	0	0	0	0	0	1	0	0

HYDROGRAPH DATA

IHYDG	IUHG	TAREA	SNAP	TRSDA	TRSPC	RATIO	ISNOW	ISAME	LOCAL
1	0	242.00	0.00	440.00	0.00	0.000	0	1	0

PRECIP DATA

SPFE	PMS	R6	R12	R24	R48	R72	R96
0.00	18.50	72.00	87.00	98.00	104.00	0.00	0.00

TRSPC COMPUTED BY THE PROGRAM IS 0.898

LOSS DATA

LROPT	STRKR	DLTKR	RTIOL	ERAIN	STRKS	RTIOK	STRTL	CNSTL	ALSMA	RTIMP
1	0.00	0.00	1.00	0.00	0.00	1.00	1.00	0.07	0.00	0.00

UNIT HYDROGRAPH DATA
TC= 20.07 R= 14.59 NTA= 0

RECESSION DATA
STRTQ= 440.00 QRCSN= 3400.00 RTIOR= 1.30

UNIT HYDROGRAPH 89 END-OF-PERIOD ORDINATES, LAG= 17.85 HOURS, CP= 0.67 VOL= 1.00

21.	30.	627.	1006.	1426.	1877.	2349.	2839.	3340.	3851.
4369.	4796.	5171.	5476.	5714.	5884.	5985.	6014.	5963.	5809.
5514.	5150.	4809.	4490.	4192.	3915.	3655.	3413.	3187.	2976.
2778.	2594.	2422.	2262.	2112.	1972.	1841.	1719.	1605.	1499.
1400.	1307.	1220.	1139.	1064.	993.	928.	866.	809.	755.
705.	658.	615.	574.	536.	500.	467.	436.	407.	380.
355.	332.	310.	289.	270.	252.	235.	220.	205.	192.
179.	167.	156.	146.	136.	127.	119.	111.	103.	97.
90.	84.	79.	73.	69.	64.	60.	56.	52.	

END-OF-PERIOD FLOW

MO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q	MO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q
									SUM	17.27	14.47	2.80	2138186.
										(439.)	(368.)	(71.)	(60546.63)

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COMBINE HYDROGRAPHS

COMBINE 2 HYDROGRAPHS AT BATTENVILLE, NY

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
55	2	0	0	0	0	1	0	0

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HYDROGRAPH ROUTING

ROUTE TO CLARKS MILLS DAM

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
5556	1	0	0	0	0	1	0	0

ROUTING DATA

QLOSS	CLOSS	AVG	IRES	ISAME	IOPT	IPMP	LSTR
0.0	0.000	0.00	0	1	0	0	0

NSTPS	NSTDL	LAG	AMSKK	X	TSK	STORA	ISPRAT
1	0	0	2.900	0.300	0.000	0.	0

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SUB-AREA RUNOFF COMPUTATION

RUN-OFF SUBAREA 56.1

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
56.1	0	0	0	0	0	1	0	0

HYDROGRAPH DATA

IHYDG	IUHG	TAREA	SNAP	TRSDA	TRSPC	RATIO	ISNOW	ISAME	LOCAL
1	0	46.90	0.00	440.00	0.00	0.000	0	1	0

PRECIP DATA

SPFE	PMS	R6	R12	R24	R48	R72	R96
0.00	18.50	72.00	87.00	98.00	104.00	0.00	0.00

TRSPC COMPUTED BY THE PROGRAM IS 0.898

LOSS DATA

LROPT	STRKR	DLTKR	RTIOL	ERAIN	STRKS	RTIOK	STRTL	CNSTL	ALSMX	RTIMP
1	0.00	0.00	1.00	0.00	0.00	1.00	1.00	0.07	0.00	0.00

UNIT HYDROGRAPH DATA

TC= 11.60 R= 6.70 NTA= 0

RECESSION DATA

STRTQ= 62.00 QRCSN= 460.00 RTIOR= 1.30

UNIT HYDROGRAPH 42 END-OF-PERIOD ORDINATES, LAG= 9.90 HOURS, CP= 0.72 VOL= 1.00

75.	277.	554.	866.	1196.	1533.	1838.	2065.	2205.	2260.
2227.	2070.	1817.	1565.	1347.	1160.	999.	860.	741.	638.
549.	473.	407.	351.	302.	260.	224.	193.	166.	143.
123.	106.	91.	79.	68.	58.	50.	43.	37.	32.
28.	24.								

0 END-OF-PERIOD FLOW

MO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q	MO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q
									SUM	17.27	14.47	2.80	441296.
										(439.)	(368.)	(71.)	(12496.10)

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COMBINE HYDROGRAPHS

COMBINE 2 HYDROGRAPHS AT CLARKS MILLS DAM

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
56.1	2	0	0	0	0	1	0	0

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HYDROGRAPH ROUTING

HYDROGRAPH ROUTING

ROUTE OVER CLARKS MILLS DAM

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	ICLTO
56.1	1	0	0	0	0	1	0	0

ROUTING DATA

QLOSS	CLOSS	AVG	IRES	ISAME	IOPT	IPMP	LSTR
0.0	0.000	0.00	1	1	0	0	0

NSTPS	NSTDL	LAG	AMSKK	X	TSK	STORA	ISPRAT
1	0	0	0.000	0.000	0.000	-134.	-1

STAGE	134.00	135.00	136.00	137.00	138.00	139.00	140.00	141.00	142.00
	144.00	146.00	148.00	150.00	152.00	154.00	156.00	158.00	160.00
FLOW	0.00	1110.00	3245.00	6100.00	9640.00	13780.00	18350.00	23350.00	28815.00
	40665.00	53455.00	67365.00	82305.00	96210.00	115020.00	132700.00	151200.00	170490.00
CAPACITY=	0.	19.	71.	161.	286.	446.	642.	874.	1106.	1296.
	1498.	1822.	2049.	2279.	2513.	2750.	2990.	3234.	3481.	3732.
ELEVATION=	113.	116.	119.	122.	125.	128.	131.	134.	137.	139.
	141.	144.	146.	148.	150.	152.	154.	156.	158.	160.

CREL	SPWID	COGW	EXPW	ELEVL	COQL	CAREA	EXPL
134.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

DAM DATA

TOPEL	COQD	EXPD	DAMWID
141.0	2.6	1.5	55.

PEAK OUTFLOW IS 29543. AT TIME 61.00 HOURS

PEAK OUTFLOW IS 44316. AT TIME 61.00 HOURS

PEAK OUTFLOW IS 59098. AT TIME 61.00 HOURS

PEAK OUTFLOW IS 73874. AT TIME 61.00 HOURS

PEAK OUTFLOW IS 88655. AT TIME 61.00 HOURS

PEAK OUTFLOW IS 118214. AT TIME 61.00 HOURS

PEAK OUTFLOW IS 147778. AT TIME 61.00 HOURS

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HYDROGRAPH ROUTING

ROUTE TO DOWNSTREAM REACHES

ISTAG	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
56.2	1	0	0	0	0	1	0	0

ROUTING DATA

QLOSS	CLOSS	AVG	IRES	ISAME	IOPT	IPMP	LSTR
0.0	0.000	0.00	1	1	0	0	0

NSTPS	NSTDL	LAG	AMSKK	X	TSK	STORA	ISPRAT
1	0	0	0.000	0.000	0.000	-1.	0

NORMAL DEPTH CHANNEL ROUTING

QN(1)	QN(2)	QN(3)	ELNVT	ELMAX	RLNTH	SEL
0.0600	0.0400	0.0600	109.0	130.0	600.	0.00700

CROSS SECTION COORDINATES--STA,ELEV,STA,ELEV--ETC

500.00 130.00 1150.00 120.00 1270.00 118.00 1290.00 109.00 1650.00 109.00
1670.00 118.00 1800.00 120.00 1860.00 130.00

STORAGE	0.00	5.52	11.11	16.76	22.52	28.34	34.23	40.20	46.24
	62.04	72.59	84.34	97.28	111.41	126.74	143.26	160.98	179.89
OUTFLOW	0.00	1327.51	4220.89	8309.38	13443.32	19532.38	26514.34	34343.06	42982.84
	63942.87	76576.31	90722.27	106443.31	123808.16	142866.81	163748.88	186463.09	211097.50
STAGE	109.00	110.11	111.21	112.32	113.42	114.53	115.63	116.74	117.84
	120.05	121.16	122.26	123.37	124.47	125.58	126.68	127.79	128.89
FLOW	0.00	1327.51	4220.89	8309.38	13443.32	19532.38	26514.34	34343.06	42982.84
	63942.87	76576.31	90722.27	106443.31	123808.16	142866.81	163748.88	186463.09	211097.50

MAXIMUM STAGE IS 116.1

MAXIMUM STAGE IS 118.0

MAXIMUM STAGE IS 119.6

MAXIMUM STAGE IS 120.9

MAXIMUM STAGE IS 122.1

MAXIMUM STAGE IS 124.1

MAXIMUM STAGE IS 125.6

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HYDROGRAPH ROUTED

HYDROGRAPH ROUTING

ROUTE OVER DOWNSTREAM DAM (BY RESARCH LAB)

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
56.3	1	0	0	0	0	1	0	0

ROUTING DATA

QLOSS	CLOSS	AVG	IRES	ISAME	IOPT	IPMP	LSTR
0.0	0.000	0.00	1	1	0	0	0

NSTPS	NSTDL	LAG	AMSKK	X	TSK	STORA	ISPRAT
1	0	0	0.000	0.000	0.000	-101.	-1

STAGE	101.00	103.00	105.00	107.00	109.00	111.00	113.00	115.00	117.00
	121.00	123.00	125.00	127.00	129.00	131.00			
FLOW	0.00	2630.00	7870.00	14550.00	22740.00	32445.00	43900.00	56760.00	69120.00
	97940.00	112990.00	128750.00	145170.00	162240.00	179930.00			
CAPACITY=	0.	130.	523.	757.					
ELEVATION=	101.	105.	110.	120.					

CREL	SPWID	COQW	EXPW	ELEVL	COQL	CAREA	EXPL
101.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

DAM DATA

TOPEL	COQD	EXPD	DAMWID
107.0	2.6	1.5	100.

PEAK OUTFLOW IS 29549. AT TIME 62.00 HOURS

PEAK OUTFLOW IS 44318. AT TIME 62.00 HOURS

PEAK OUTFLOW IS 59088. AT TIME 62.00 HOURS

PEAK OUTFLOW IS 73849. AT TIME 62.00 HOURS

PEAK OUTFLOW IS 88616. AT TIME 61.00 HOURS

PEAK OUTFLOW IS 118169. AT TIME 61.00 HOURS

PEAK OUTFLOW IS 147727. AT TIME 61.00 HOURS

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PEAK FLOW AND STORAGE (END OF PERIOD) SUMMARY FOR MULTIPLE PLAN-RATIO ECONOMIC COMPUTATIONS
FLOWS IN CUBIC FEET PER SECOND (CUBIC METERS PER SECOND)
AREA IN SQUARE MILES (SQUARE KILOMETERS)

OPERATION	STATION	AREA	PLAN	RATIOS APPLIED TO FLOWS						
				RATIO 1 0.20	RATIO 2 0.30	RATIO 3 0.40	RATIO 4 0.50	RATIO 5 0.60	RATIO 6 0.80	RATIO 7 1.00
HYDROGRAPH AT	54	152.00 (393.68)	1	15134. (428.56)	22701. (642.83)	30269. (857.11)	37836. (1071.39)	45403. (1285.67)	60537. (1714.22)	75672. (2142.78)
ROUTED TO	5455	152.00 (393.68)	1	14289. (404.62)	21433. (606.92)	28578. (809.23)	35722. (1011.54)	42867. (1213.85)	57156. (1618.46)	71444. (2023.08)
HYDROGRAPH AT	55	242.00 (626.77)	1	16324. (462.23)	24485. (693.35)	32647. (924.47)	40809. (1155.58)	48971. (1386.70)	65295. (1848.93)	81618. (2311.17)
2 COMBINED	55	394.00 (1020.45)	1	29052. (822.67)	43579. (1234.01)	58105. (1645.34)	72631. (2056.68)	87157. (2468.01)	116210. (3290.68)	145262. (4113.35)
ROUTED TO	5556	394.00 (1020.45)	1	28380. (803.63)	42570. (1205.45)	56760. (1607.26)	70950. (2009.08)	85140. (2410.89)	113520. (3214.52)	141900. (4018.15)
HYDROGRAPH AT	56.1	46.90 (121.47)	1	5591. (158.32)	8387. (237.48)	11182. (316.64)	13978. (395.80)	16773. (474.96)	22364. (633.28)	27955. (791.60)
2 COMBINED	56.1	440.90 (1141.92)	1	29579. (837.57)	44368. (1256.36)	59157. (1675.14)	73946. (2093.93)	88736. (2512.71)	118314. (3350.28)	147893. (4187.85)
ROUTED TO	56.1	440.90 (1141.92)	1	29543. (836.56)	44316. (1254.88)	59098. (1673.45)	73874. (2091.69)	88655. (2510.42)	118214. (3347.45)	147778. (4184.61)
ROUTED TO	56.2	440.90 (1141.92)	1	29536. (836.38)	44305. (1254.57)	59109. (1673.79)	73867. (2091.69)	88644. (2510.12)	118209. (3347.31)	147765. (4184.23)
ROUTED TO	56.3	440.90 (1141.92)	1	29549. (836.74)	44318. (1254.94)	59088. (1673.18)	73849. (2091.18)	88616. (2509.33)	118169. (3346.18)	147727. (4183.15)

SUMMARY OF DAM SAFETY ANALYSIS

PLAN 1 .....

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	134.00	134.00	141.00
STORAGE	874.	874.	1498.
OUTFLOW	0.	0.	23350.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
0.20	142.10	1.10	1610.	29543.	14.00	61.00	0.00
0.30	144.43	3.43	1870.	44316.	24.00	61.00	0.00
0.40	146.54	5.54	2111.	59098.	30.00	61.00	0.00
0.50	148.47	7.47	2334.	73874.	33.00	61.00	0.00
0.60	150.28	9.28	2546.	88655.	36.00	61.00	0.00
0.80	153.61	12.61	2945.	118214.	40.00	61.00	0.00
1.00	156.66	15.66	3315.	147778.	44.00	61.00	0.00

PLAN 1 STATION 56.2

RATIO	MAXIMUM FLOW,CFS	MAXIMUM STAGE,FT	TIME HOURS
0.20	29536.	116.1	61.00
0.30	44305.	118.0	61.00
0.40	59109.	119.6	61.00
0.50	73867.	120.9	61.00
0.60	88644.	122.1	61.00
0.80	118209.	124.1	61.00
1.00	147765.	125.8	61.00

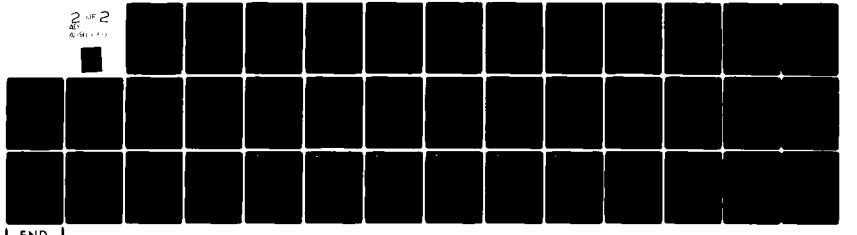
SUMMARY OF DAM SAFETY ANALYSIS

PLAN 1 .....

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	101.00	101.00	137.00
STORAGE	0.	0.	207.
OUTFLOW	0.	0.	14550.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
0.20	110.11	3.11	326.	29549.	25.00	62.00	0.00
0.30	112.48	5.48	451.	44318.	33.00	62.00	0.00
0.40	114.57	7.57	521.	59088.	37.00	62.00	0.00
0.50	116.53	9.53	606.	73849.	41.00	62.00	0.00
0.60	118.31	11.31	685.	88616.	44.00	61.00	0.00
0.80	121.71	14.71	831.	118169.	48.00	61.00	0.00
1.00	124.88	17.88	969.	147727.	49.00	61.00	0.00

AD-A091 130 NEW YORK STATE DEPT OF ENVIRONMENTAL CONSERVATION ALBANY F/G 13/13
NATIONAL DAM SAFETY PROGRAM. CLARKS MILLS DAM, (INVENTORY NUMBE--ETC(U)
AUG 80 J B STETSON DACW51-79-C-0001
UNCLASSIFIED NL



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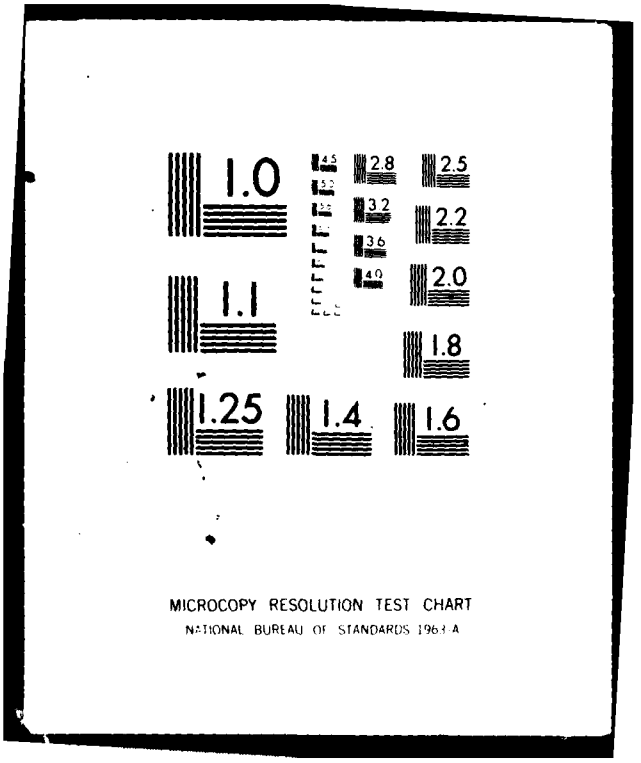
1.0
1.1
1.25
1.4
1.6
1.8
2.0
2.2
2.5
2.8
3.2
3.6
4.0
4.5
MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS 1963-A

RKS LL AM 6E 3

```
(0077)   K      99
(0078)   A
(0079)   A
(0080)   A
(0081)   A
(0082)   A
```

```
(0039)   K       2    56.1        C        C        C        C        1
(0040)   K1        COMBINE 2 HYDROGRAPHS AT CLARKS MILLS DAM
(0041)   K       1    56.1        C        C        C        C        1
(0042)   K1        ROUTE OVER CLARKS MILLS DAM
(0043)   Y       0        0        0        1        1
(0044)   Y1      1        0        0        0        0        0    -134.       -1
(0045)   Y4    134      135      136      137      138      139      140      141      142      143
(0046)   Y4    144      146      148      150      152      154      156      158      160
(0047)   Y5      0     1110     3245     6100     9640    13780    18350    23350    28815    34725
(0048)   Y5  40665    53455    67365    82305    98210   115020   132700   151200   170490
(0049)   $S      0     17.8     71.4    160.6    285.5      446      642      874     1106     1296
(0050)   $S   1498     1822     2049     2279     2513     2750     2990     3234     3481     3732
(0051)   $E    113      116      119      122      125      128      131      134      137      139
(0052)   $E    141      144      146      148      150      152      154      156      158      160
(0053)   $$   134.
(0054)   $D   141.     2.64      1.5       55
(0055)   $B     90       0.      113      0.1     134.     148.
(0056)   $B     90       0.      113      0.3     134.     148.
(0057)   $B     90       0.      113      0.5     134.     148.
(0058)   K       1    56.2        0        0        0        2        1
(0059)   K1        ROUTE  TO  DOWNSTREAM HOUSES
(0060)   Y       0        0        0        1        1
(0061)   Y1      1        0        0        0        0        0       -1
(0062)   Y6   .060    0.040     .060      109      130      600     .007
(0063)   Y7   500      130     1150      120     1270      118     1290      109     1650      109
(0064)   Y7  1670      118     1800      120     1860      130
(0065)   K       1    56.3        0        0        0        2        1
(0066)   K1        ROUTE  OVER DOWNSTREAM DAM (BY RESARCH LAB)
(0067)   Y       0        0        0        1        1
(0068)   Y1      1        0        0        0        0        0    -101.       -1
(0069)   Y4    101      103      105      107      109      111      113      115      117      119
(0070)   Y4    121      123      125      127      129      131
(0071)   Y5      0     2630     7870    14550    22740    32445    43900    56260    69120    83620
(0072)   Y5  97940   112990   128750   145170   162240   179930
(0073)   $S      0      130      323      757
(0074)   $E    101      105      110      120
(0075)   $$   101.
(0076)   $D   107.     2.64      1.5      100
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(0001)   A1                    CLARKS MILLS DAM
(0002)   A2                    0.5 PMF DAMBREAK ANALYSIS
(0003)   A3                    MODEL DERIVED FROM UPPER HUDSON C OF E MODEL
(0004)   B     300        C        2C        C        C        C        C        C        4
(0005)   B1      5
(0006)   J       5        1         1
(0007)   J1    0.5
(0008)   K       0       54         C        C        C        C        1
(0009)   K1       HYDROGRAPH AT ARLINGTON, VT
(0010)   M       1        0       152        0      44C        0        C        C        1
(0011)   P       0     18.5        72       87       98      104
(0012)   T       C        0         C        C        C        0     1.25   C.075
(0013)   V   15.41     7.91
(0014)   X     250     1950       1.3
(0015)   K       1     5455         C        C        C        C        1
(0016)   K1       ROUTE TO 1C55 BATTENVILLE, NY
(0017)   Y       0        0         C        0        1
(0018)   Y1      7        C         0     1.42       .3
(0019)   K       C       55         C        C        C        0        1
(0020)   K1       SUB-AREA RUN-OFF
(0021)   M       1        0       242        0      44C        0        C        C        1
(0022)   P       C     18.5        72       87       98      104
(0023)   T       3        0         0        0        C        0     1.C   C.075
(0024)   V   20.07    14.59
(0025)   X     44C     3400       1.3
(0026)   K       2       55         0        0        C        C        1
(0027)   K1       COMBINE 2 HYDROGRAPHS AT BATTENVILLE, NY
(0028)   K       1     5556         0        0        C        0        1
(0029)   K1       ROUTE TO CLARKS MILLS DAM
(0030)   Y       0        0         C        C        1
(0031)   Y1      1        0         C      2.9       .3
(0032)   K       0     56.1         0        0        C        C        1
(0033)   K1       RUN-OFF SUBAREA 56.1
(0034)   M       1        0      46.9        0      44C        0        C        C        1
(0035)   P       0     18.5        72       87       98      104
(0036)   T       C        0         0        C        C        0     1.C   C.075
(0037)   V    11.6      6.7
(0038)   X      62      46C       1.3
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PREVIEW OF SEQUENCE OF STREAM NETWORK CALCULATIONS

RUNOFF HYDROGRAPH AT	54
ROUTE HYDROGRAPH TO	5455
RUNOFF HYDROGRAPH AT	55
COMBINE 2 HYDROGRAPHS AT	55
ROUTE HYDROGRAPH TO	5556
RUNOFF HYDROGRAPH AT	56.1
COMBINE 2 HYDROGRAPHS AT	56.1
ROUTE HYDROGRAPH TO	56.1
ROUTE HYDROGRAPH TO	56.2
ROUTE HYDROGRAPH TO	56.3
END OF NETWORK	

```
**********************************
FLOOD HYDROGRAPH PACKAGE (HEC-1)
DAM SAFETY VERSION      JULY 1978
  LAST MODIFICATION  26 FEB 79
**********************************

RUN  DATE?TUE, JUN 03 1980
     TIME?13:19:48
```

CLARKS MILLS DAM
C.5 PMF DAMBREAK ANALYSIS
MODEL DERIVED FROM UPPER HUDSON C OF E MODEL

JOB SPECIFICATION

NQ	NHR	NMIN	IDAY	IHR	IMIN	METRC	IPLT	IPRT	NSTAN
300	0	20	C	0	0	0	0	4	0

JOPER	NWT	LROPT	TRACE
5	0	0	0

MULTI-PLAN ANALYSES TO BE PERFORMED
NPLAN= 3 NRTIO= 1 LRTIO= 1

RTIOS= 0.5C

********** ********** ********** ********** **********

SUB-AREA RUNOFF COMPUTATION

HYDROGRAPH AT ARLINGTON, VT

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
54	0	0	0	0	0	1	0	0

HYDROGRAPH DATA

IHYDG	IUHG	TAREA	SNAP	TRSDA	TRSPC	RATIO	ISNOW	ISAME	LOCAL
1	C	152.CO	0.CC	440.00	0.00	0.000	0	1	0

PRECIP DATA

SPFE	PMS	R6	R12	R24	R48	R72	R96
0.CC	18.50	72.00	87.00	98.00	104.00	C.00	C.00

TRSPC COMPUTED BY THE PROGRAM IS C.898

LOSS DATA

LROPT	STRKR	DLTKR	RTIOL	ERAIN	STRKS	RTIOK	STRTL	CNSTL	ALSMX	RTIMP
C	0.00	0.0C	1.0C	C.00	0.00	1.00	1.25	0.07	C.CC	0.CC

UNIT HYDROGRAPH DATA
TC= 15.41 R= 7.91 NTA= C

RECESSION DATA
STRTQ= 250.CC QRCSN= 1950.00 RTIOR= 1.30

UNIT HYDROGRAPH 100 END-OF-PERIOD ORDINATES, LAG= 13.04 HOURS, CP= 0.75 VOL= 0.96

27.	103.	214.	346.	495.	658.	831.	1013.	1205.	1399.
1600.	1806.	2015.	2227.	2442.	2658.	2876.	3095.	3315.	3535.
3755.	3976.	4196.	4412.	4616.	4803.	4973.	5127.	5265.	5388.
5496.	5589.	5667.	5731.	5781.	5817.	5838.	5846.	5840.	5819.
5783.	5731.	5663.	5576.	5467.	5329.	5147.	4937.	4733.	4538.
4351.	4171.	3999.	3834.	3676.	3524.	3379.	3239.	3106.	2977.
2854.	2737.	2624.	2515.	2412.	2312.	2217.	2125.	2037.	1953.
1873.	1795.	1721.	1650.	1582.	1517.	1454.	1394.	1337.	1282.
1229.	1178.	1129.	1083.	1038.	995.	954.	915.	877.	841.
806.	773.	741.	710.	681.	653.	626.	600.	575.	552.

0 END-OF-PERIOD FLOW

MO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q	MO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q
									SUM	17.27	14.38	2.89	4109190.
										(439.)	(365.)	(74.)	($116359.)

********** ********** ********** ********** **********

HYDROGRAPH ROUTING

ROUTE TO 1055 BATTENVILLE, NY

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
5455	1	0	0	0	0	1	0	0

ALL PLANS HAVE SAME ROUTING DATA

QLOSS	CLOSS	AVG	IRES	ISAME	IOPT	IPMP	LSTR
0.0	0.000	0.00	0	1	0	0	0

NSTPS	NSTDL	LAG	AMSKK	X	TSK	STORA	ISPRAT
7	0	0	1.420	0.300	0.000	0.	0

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SUB-AREA RUNOFF COMPUTATION

SUB-AREA RUN-OFF

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
55	0	0	0	0	0	1	0	0

HYDROGRAPH DATA

IHYDG	IUHG	TAREA	SNAP	TRSDA	TRSPC	RATIO	ISNOW	ISAME	LOCAL
1	0	242.00	0.00	440.00	0.00	0.000	0	1	0

PRECIP DATA

	SPFE	PMS	R6	R12	R24	R48	R72	R96
	0.00	18.50	72.00	87.00	98.00	104.00	0.00	0.00

TRSPC COMPUTED BY THE PROGRAM IS 0.898

LOSS DATA

LROPT	STRKR	DLTKR	RTIOL	ERAIN	STRKS	RTIOK	STRTL	CNSTL	ALSMX	RTIMP
0	0.00	0.00	1.00	0.00	0.00	1.00	1.00	0.07	0.00	0.00

UNIT HYDROGRAPH DATA

TC= 20.07 R= 14.59 NTA= 0

RECESSION DATA

STRTQ= 440.00 QRCSN= 3400.00 RTIOR= 1.30

UNIT HYDROGRAPH 100 END-OF-PERIOD ORDINATES, LAG= 18.12 HOURS, CP= 0.67 VOL= 0.79

16.	61.	127.	207.	298.	398.	507.	622.	744.	871.
1003.	1140.	1280.	1425.	1572.	1723.	1876.	2031.	2189.	2349.
2511.	2674.	2839.	3005.	3173.	3341.	3510.	3681.	3852.	4023.
4194.	4359.	4515.	4664.	4804.	4937.	5062.	5179.	5288.	5390.
5484.	5570.	5649.	5721.	5785.	5842.	5891.	5932.	5966.	5992.
6010.	6020.	6022.	6014.	5998.	5972.	5935.	5887.	5825.	5744.
5636.	5510.	5386.	5264.	5145.	5029.	4915.	4804.	4696.	4590.
4486.	4385.	4286.	4189.	4094.	4002.	3911.	3823.	3737.	3652.
3570.	3489.	3410.	3333.	3258.	3184.	3112.	3042.	2973.	2906.
2841.	2776.	2714.	2652.	2592.	2534.	2477.	2421.	2366.	2313.

END-OF-PERIOD FLOW

MO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q	MO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q
									SUM	17.27	14.47	2.80	5438463.
										(439.)	(368.)	(71.)	($153999.)

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COMBINE HYDROGRAPHS

COMBINE 2 HYDROGRAPHS AT BATTENVILLE, NY

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
55	2	0	0	0	0	1	0	0

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HYDROGRAPH ROUTING

ROUTE TO CLARKS MILLS DAM

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
5556	1	0	0	0	0	1	0	0

ALL PLANS HAVE SAME
ROUTING DATA

QLOSS	CLOSS	AVG	IRES	ISAME	IOPT	IPMP	LSTR
0.0	0.000	0.00	0	1	0	0	C

NSTPS	NSTDL	LAG	AMSKK	X	TSK	STORA	ISPRAT
1	0	0	2.500	0.300	0.000	0.	C

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SUB-AREA RUNOFF COMPUTATION

RUN-OFF SUBAREA 56.1

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
56.1	0	0	0	0	0	1	0	0

HYDROGRAPH DATA

IHYDG	IUHG	TAREA	SNAP	TRSDA	TRSPC	RATIO	ISNOW	ISAME	LOCAL
1	0	46.90	0.00	440.00	0.00	0.000	0	1	0

PRECIP DATA

SPFE	PMS	R6	R12	R24	R48	R72	R96
0.00	18.50	72.00	87.00	98.00	104.00	0.00	0.00

TRSPC COMPUTED BY THE PROGRAM IS 0.898

LOSS DATA

LROPT	STRKR	DLTKR	RTIOL	ERAIN	STRKS	RTIOK	STRTL	CNSTL	ALSMX	RTIMP
0	0.00	0.00	1.00	0.00	0.00	1.00	1.00	0.07	0.00	0.00

UNIT HYDROGRAPH DATA

TC= 11.60 R= 6.70 NTA= 0

RECESSION DATA

STRTQ= 62.00 QRCSN= 460.00 RTIOR= 1.30

UNIT HYDROGRAPH 100 END-OF-PERIOD ORDINATES, LAG= 10.03 HOURS, CP= 0.72 VOL= 0.98

15.	57.	118.	191.	273.	361.	455.	553.	655.	760.
867.	975.	1086.	1197.	1309.	1422.	1535.	1647.	1753.	1849.
1935.	2010.	2075.	2131.	2177.	2213.	2241.	2259.	2268.	2268.
2257.	2236.	2203.	2156.	2088.	1998.	1901.	1809.	1721.	1637.
1558.	1482.	1410.	1342.	1277.	1215.	1156.	1100.	1046.	995.
947.	901.	857.	816.	776.	738.	703.	669.	636.	605.
576.	548.	521.	496.	472.	449.	427.	406.	387.	368.
350.	333.	317.	302.	287.	273.	260.	247.	235.	224.
213.	203.	193.	183.	174.	166.	158.	150.	143.	136.
129.	123.	117.	111.	106.	101.	96.	91.	87.	83.

0 END-OF-PERIOD FLOW

MO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q	MO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q
									SUM	17.27	14.47	2.80	1305466.
										(439.)	(368.)	(71.)	(36966.64)

********** ********** ********** ********** **********

COMBINE HYDROGRAPHS

COMBINE 2 HYDROGRAPHS AT CLARKS MILLS DAM

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JFRT	INAME	ISTAGE	IAUTO
56.1	2	0	0	0	0	1	0	0

********** ********** ********** ********** **********

HYDROGRAPH ROUTING

ROUTE OVER CLARKS MILLS DAM

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JFRT	INAME	ISTAGE	IAUTO
56.1	1	0	0	0	0	1	0	0

ALL PLANS HAVE SAME ROUTING DATA

QLOSS	CLOSS	AVG	IRES	ISAME	IOPT	IPMP	LSTR
0.0	0.000	0.00	1	1	0	0	0

NSTPS	NSTDL	LAG	AMSKK	X	TSK	STORA	ISPRAT
1	0	0	0.000	0.000	0.000	-134.	-1

STAGE	134.00	135.00	136.00	137.00	138.00	139.00	140.00	141.00	142.00
	144.00	146.00	148.00	150.00	152.00	154.00	156.00	158.00	160.00
FLOW	0.00	1110.00	3245.00	6100.00	9640.00	13780.00	18350.00	23350.00	28815.00
	40665.00	53455.00	67365.00	82305.00	98210.00	115020.00	132700.00	151200.00	170490.00
CAPACITY=	0.	18.	71.	161.	286.	446.	642.	874.	1106.	1296.
	1498.	1822.	2049.	2279.	2513.	2750.	2990.	3234.	3481.	3732.
ELEVATION=	113.	116.	119.	122.	125.	128.	131.	134.	137.	139.
	141.	144.	146.	148.	150.	152.	154.	156.	158.	160.

CREL	SPWID	COQW	EXPW	ELEVL	COQL	CAREA	EXPL
134.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

DAM DATA

TOPEL	COQD	EXPD	DAMWID
141.0	2.6	1.5	55.

DAM BREACH DATA

BRWID	Z	ELBM	TFAIL	WSEL	FAILEL
90.	0.00	113.00	0.10	134.00	148.00

BEGIN DAM FAILURE AT 58.67 HOURS

PEAK OUTFLOW IS 112286. AT TIME 58.77 HOURS

DAM BREACH DATA

BRWID	Z	ELBM	TFAIL	WSEL	FAILEL
9C.	0.00	113.00	0.30	134.00	148.00

BEGIN DAM FAILURE AT 58.67 HOURS

PEAK OUTFLOW IS 96149. AT TIME 58.96 HOURS

DAM BREACH DATA

BRWID	Z	ELBM	TFAIL	WSEL	FAILEL
9C.	0.00	113.00	0.50	134.00	148.00

BEGIN DAM FAILURE AT 58.67 HOURS

PEAK OUTFLOW IS 88777. AT TIME 59.16 HOURS

********** ********** ********** ********** **********

HYDROGRAPH ROUTING

ROUTE TO DOWNSTREAM HOUSES

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
56.2	1	0	0	0	2	1	C	0

ALL PLANS HAVE SAME ROUTING DATA

QLOSS	CLOSS	AVG	IRES	ISAME	IOPT	IPMP	LSTR
0.0	0.000	0.00	1	1	0	0	C

NSTPS	NSTDL	LAG	AMSKK	X	TSK	STORA	ISPRAT
1	0	0	0.000	0.000	0.000	-1.	0

NORMAL DEPTH CHANNEL ROUTING

QN(1)	QN(2)	QN(3)	ELNVT	ELMAX	RLNTH	SEL
0.0600	0.0400	0.0600	109.0	130.0	600.	0.00700

CROSS SECTION COORDINATES--STA,ELEV,STA,ELEV--ETC

500.00 130.00 1150.00 120.00 1270.00 118.00 1290.00 109.00 1650.00 109.00
1670.00 118.00 1800.00 120.00 1860.00 130.00

STORAGE	0.00	5.52	11.11	16.78	22.52	28.34	- 34.23	40.20	46.24
	62.04	72.59	84.34	97.28	111.41	126.74	143.26	160.98	179.89
OUTFLOW	0.00	1327.51	4220.89	8309.38	13443.32	19532.38	26514.34	34343.06	42982.84
	63942.87	76576.31	90722.27	106443.31	123808.16	142888.81	163748.55	186463.09	211067.50

STAGE	109.00	110.11	111.21	112.32	113.42	114.53	115.63	116.74	117.84
	120.05	121.16	122.26	123.37	124.47	125.58	126.68	127.79	128.89
FLOW	0.00	1327.51	4220.89	8309.38	13443.32	19532.38	26514.34	34343.06	42982.84
	63942.87	76576.31	90722.27	106443.31	123808.16	142866.81	163748.88	186463.09	211097.50

STATION 56.2, PLAN 1, RTIO 1

OUTFLOW

121.	183.	254.	286.	315.	329.	340.	346.	349.	349.
346.	346.	343.	340.	336.	332.	328.	324.	319.	315.
310.	306.	302.	298.	293.	289.	285.	281.	277.	273.
269.	265.	261.	257.	252.	248.	244.	240.	236.	231.
227.	222.	218.	214.	209.	205.	200.	196.	191.	187.
183.	179.	174.	170.	166.	162.	158.	154.	151.	147.
143.	140.	136.	133.	129.	126.	123.	120.	117.	114.
111.	108.	105.	102.	100.	98.	96.	95.	94.	95.
96.	98.	101.	105.	111.	118.	127.	137.	149.	162.
178.	195.	215.	238.	265.	297.	334.	377.	428.	485.
551.	625.	709.	803.	907.	1022.	1177.	1390.	1601.	1774.
1983.	2185.	2421.	2667.	2948.	3255.	3658.	4070.	4510.	5003.
5561.	6195.	6905.	7691.	8554.	9497.	10581.	11711.	12846.	14070.
15330.	16632.	17950.	19365.	20785.	22187.	23607.	25039.	26457.	27857.
29247.	30657.	32006.	33326.	34626.	35909.	37168.	38414.	39645.	40868.
42086.	43295.	44479.	45643.	46794.	47952.	49120.	50301.	51491.	52693.
53897.	55126.	56386.	57629.	58851.	60081.	61284.	62482.	63644.	64785.
65884.	66944.	67951.	68907.	69795.	70630.	79689.	72728.	71758.	73876.
72792.	74340.	73354.	74413.	73465.	74102.	73146.	73415.	72420.	72376.
71353.	71058.	69942.	69375.	68158.	67368.	66064.	65092.	63717.	62599.
61166.	59940.	58469.	57172.	55719.	54373.	52878.	51495.	50060.	48734.
47287.	45888.	44408.	43025.	41538.	40072.	38541.	37036.	35832.	34387.
32461.	30570.	28850.	27229.	25826.	24458.	22979.	21575.	20112.	18800.
17634.	16601.	15585.	14636.	13814.	13087.	12411.	11789.	11141.	10522.
9978.	9473.	8994.	8533.	8094.	7666.	7193.	6735.	6339.	5967.
5617.	5282.	4966.	4666.	4384.	4121.	3805.	3539.	3335.	3130.
2954.	2782.	2630.	2485.	2355.	2233.	2122.	2019.	1925.	1837.
1757.	1682.	1613.	1549.	1490.	1428.	1348.	1306.	1266.	1221.
1183.	1145.	1110.	1076.	1044.	1013.	984.	956.	929.	903.
878.	854.	831.	808.	786.	765.	745.	725.	706.	687.

STOR

1.	1.	1.	1.	1.	1.	1.	1.	1.	1.
1.	1.	1.	1.	1.	1.	1.	1.	1.	1.
1.	1.	1.	1.	1.	1.	1.	1.	1.	1.
1.	1.	1.	1.	1.	1.	1.	1.	1.	1.
1.	1.	1.	1.	1.	1.	1.	1.	1.	1.
1.	1.	1.	1.	1.	1.	1.	1.	1.	1.
1.	1.	1.	1.	1.	1.	1.	1.	1.	1.
1.	1.	1.	1.	1.	1.	1.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	1.	1.	1.	1.

..	..	..	..	..	..	..	..	..	..
1.	1.	1.	1.	1.	1.	1.	2.	2.	2.
2.	3.	3.	3.	4.	4.	5.	6.	6.	6.
7.	7.	8.	8.	9.	9.	10.	11.	12.	12.
13.	14.	15.	16.	17.	18.	19.	21.	22.	23.
24.	26.	27.	28.	29.	31.	32.	33.	34.	35.
36.	37.	38.	39.	40.	41.	42.	43.	44.	45.
46.	46.	47.	48.	49.	50.	51.	51.	52.	53.
54.	55.	56.	57.	58.	59.	60.	61.	62.	63.
64.	65.	65.	66.	67.	68.	75.	69.	69.	70.
69.	71.	70.	71.	70.	71.	70.	70.	69.	69.
68.	68.	67.	67.	66.	65.	64.	63.	62.	61.
60.	59.	58.	57.	55.	54.	53.	52.	51.	50.
49.	48.	47.	46.	45.	44.	43.	42.	41.	40.
39.	37.	36.	35.	34.	32.	31.	30.	29.	28.
27.	26.	25.	24.	23.	22.	21.	21.	20.	19.
19.	18.	18.	17.	16.	16.	15.	15.	14.	14.
13.	13.	12.	12.	11.	11.	10.	10.	9.	9.
9.	8.	8.	8.	8.	7.	7.	7.	7.	7.
6.	6.	6.	6.	6.	6.	6.	5.	5.	5.
5.	5.	5.	4.	4.	4.	4.	4.	4.	4.
4.	4.	3.	3.	3.	3.	3.	3.	3.	3.

STAGE

109.1	109.2	109.2	109.2	109.3	109.3	109.3	109.3	109.3	109.3
109.3	109.3	109.3	109.3	109.3	109.3	109.3	109.3	109.3	109.3
109.3	109.3	109.3	109.2	109.2	109.2	109.2	109.2	109.2	109.2
109.2	109.2	109.2	109.2	109.2	109.2	109.2	109.2	109.2	109.2
109.2	109.2	109.2	109.2	109.2	109.2	109.2	109.2	109.2	109.2
109.2	109.1	109.1	109.1	109.1	109.1	109.1	109.1	109.1	109.1
109.1	109.1	109.1	109.1	109.1	109.1	109.1	109.1	109.1	109.1
109.1	109.1	109.1	109.1	109.1	109.1	109.1	109.1	109.1	109.1
109.1	109.1	109.1	109.1	109.1	109.1	109.1	109.1	109.1	109.1
109.1	109.2	109.2	109.2	109.2	109.2	109.3	109.3	109.4	109.4
109.5	109.5	109.6	109.7	109.8	109.9	110.0	110.1	110.2	110.3
110.4	110.4	110.5	110.6	110.7	110.8	111.0	111.2	111.3	111.4
111.6	111.7	111.9	112.1	112.4	112.6	112.8	113.0	113.3	113.5
113.8	114.0	114.2	114.5	114.7	114.9	115.2	115.4	115.6	115.8
116.0	116.2	116.4	116.6	116.8	116.9	117.1	117.3	117.4	117.6
117.7	117.9	118.0	118.1	118.3	118.4	118.5	118.7	118.8	118.9
119.1	119.2	119.3	119.4	119.5	119.7	119.8	119.9	120.0	120.1
120.2	120.3	120.4	120.5	120.6	120.6	121.4	120.8	120.7	120.9
120.8	121.0	120.9	121.0	120.9	120.9	120.9	120.9	120.8	120.8
120.7	120.7	120.6	120.5	120.4	120.4	120.2	120.2	120.0	119.9
119.8	119.7	119.5	119.4	119.2	119.1	119.0	118.8	118.6	118.5
118.3	118.2	118.0	117.8	117.7	117.5	117.3	117.1	116.9	116.7
116.5	116.2	116.0	115.7	115.5	115.3	115.1	114.8	114.6	114.4
114.2	114.0	113.8	113.6	113.5	113.3	113.2	113.1	112.9	112.8
112.7	112.6	112.5	112.4	112.3	112.1	112.0	111.9	111.8	111.7
111.6	111.5	111.4	111.3	111.3	111.2	111.1	110.9	110.9	110.8
110.7	110.7	110.6	110.5	110.5	110.5	110.4	110.4	110.3	110.3
110.3	110.2	110.2	110.2	110.2	110.1	110.1	110.1	110.1	110.1

110.0	110.0	109.9	109.9	109.9	109.8	109.8	109.8	109.8	109.8
109.7	109.7	109.7	109.7	109.7	109.6	109.6	109.6	109.6	109.6

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	79689.	73043.	58723.	25084.	5436114.
CMS	2257.	2068.	1663.	710.	153933.
INCHES		1.54	4.96	6.35	6.37
MM		39.14	125.88	161.31	161.85
AC-FT		36220.	116475.	149261.	149755.
THOUS CU M		44676.	143669.	184110.	184720.

MAXIMUM STORAGE = 75.

MAXIMUM STAGE IS 121.4

STATION 56.2, PLAN 2, RTIO 1

OUTFLOW

121.	183.	254.	286.	315.	329.	340.	346.	349.	349.
348.	346.	343.	340.	336.	332.	328.	324.	319.	315.
310.	306.	302.	298.	293.	289.	285.	281.	277.	273.
269.	265.	261.	257.	252.	248.	244.	240.	236.	231.
227.	222.	218.	214.	209.	205.	200.	196.	191.	187.
183.	179.	174.	170.	166.	162.	158.	154.	151.	147.
143.	140.	136.	133.	129.	126.	123.	120.	117.	114.
111.	108.	105.	102.	100.	98.	96.	95.	94.	95.
96.	98.	101.	105.	111.	118.	127.	137.	149.	162.
178.	195.	215.	238.	265.	297.	334.	377.	428.	485.
551.	625.	709.	803.	907.	1022.	1177.	1390.	1601.	1774.
1983.	2185.	2421.	2667.	2948.	3255.	3658.	4070.	4510.	5003.
5561.	6195.	6905.	7691.	8554.	9497.	10581.	11711.	12848.	14070.
15330.	16632.	17950.	19365.	20785.	22187.	23607.	25039.	26457.	27857.
29247.	30657.	32006.	33326.	34626.	35909.	37168.	38414.	39645.	40868.
42086.	43295.	44479.	45643.	46794.	47952.	49120.	50301.	51491.	52693.
53897.	55126.	56386.	57629.	58851.	60081.	61284.	62482.	63644.	64785.
65884.	66944.	67951.	68907.	69795.	70630.	71424.	73465.	70645.	74864.
71917.	75115.	72668.	75021.	72926.	74579.	72723.	73789.	72089.	72669.
71093.	71288.	69738.	69555.	67998.	67509.	65938.	65203.	63619.	62687.
61088.	60010.	58408.	57227.	55670.	54416.	52839.	51530.	50029.	48763.
47262.	45911.	44387.	43044.	41521.	40088.	38527.	37049.	35821.	34397.
32472.	30579.	28842.	27235.	25820.	24463.	22974.	21579.	20108.	18803.
17631.	16603.	15583.	14638.	13812.	13088.	12410.	11790.	11140.	10523.
9978.	9474.	8993.	8534.	8094.	7666.	7193.	6735.	6338.	5967.
5617.	5282.	4966.	4666.	4384.	4122.	3805.	3539.	3335.	3130.
2954.	2782.	2630.	2485.	2355.	2233.	2122.	2019.	1925.	1837.
1757.	1682.	1613.	1549.	1490.	1428.	1348.	1306.	1266.	1221.
1183.	1145.	1110.	1076.	1044.	1013.	984.	956.	929.	903.
878.	854.	831.	808.	786.	765.	745.	725.	706.	687.

STOR

1.	1.	1.	1.	1.	1.	1.	1.	1.	1.
1.	1.	1.	1.	1.	1.	1.	1.	1.	1.
1.	1.	1.	1.	1.	1.	1.	1.	1.	1.
1.	1.	1.	1.	1.	1.	1.	1.	1.	1.
1.	1.	1.	1.	1.	1.	1.	1.	1.	1.
1.	1.	1.	1.	1.	1.	1.	1.	1.	1.
1.	1.	1.	1.	1.	1.	1	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	1.	1.	1.	1.
1.	1.	1.	1.	1.	1.	1.	2.	2.	2.
2.	3.	3.	3.	4.	4.	5.	6.	6.	6.
7.	7.	8.	8.	9.	9.	10.	11.	12.	12.
13.	14.	15.	16.	17.	18.	19.	21.	22.	23.
24.	26.	27.	28.	29.	31.	32.	33.	34.	35.
36.	37.	38.	39.	40.	41.	42.	43.	44.	45.
46.	46.	47.	48.	49.	50.	51.	51.	52.	53.
54.	55.	56.	57.	58.	59.	60.	61.	62.	63.
64.	65.	65.	66.	67.	68.	84.	70.	68.	71.
69.	71.	69.	71.	70.	71.	69.	70.	69.	69.
68.	68.	67.	67.	65.	65.	64.	63.	62.	61.
60.	59.	58.	57.	55.	54.	53.	52.	51.	50.
49.	48.	47.	46.	45.	44.	43.	42.	41.	40.
39.	37.	36.	35.	34.	32.	31.	30.	29.	28.
27.	26.	25.	24.	23.	22.	21.	21.	20.	19.
19.	18.	18.	17.	16.	16.	15.	15.	14.	14.
13.	13.	12.	12.	11.	11.	10.	10.	9.	9.
9.	8.	8.	8.	8.	7.	7.	7.	7.	7.
6.	6.	6.	6.	6.	6.	6.	5.	5.	5.
5.	5.	5.	4.	4.	4.	4.	4.	4.	4.
4.	4.	3.	3.	3.	3.	3.	3.	3.	3.

STAGE

109.1	109.2	109.2	109.2	109.3	109.3	109.3	109.3	109.3	109.3
109.3	109.3	109.3	109.3	109.3	109.3	109.3	109.3	109.3	109.3
109.3	109.3	109.3	109.2	109.2	109.2	109.2	109.2	109.2	109.2
109.2	109.2	109.2	109.2	109.2	109.2	109.2	109.2	109.2	109.2
109.2	109.2	109.2	109.2	109.2	109.2	109.2	109.2	109.2	109.2
109.2	109.1	109.1	109.1	109.1	109.1	109.1	109.1	109.1	109.1
109.1	109.1	109.1	109.1	109.1	109.1	109.1	109.1	109.1	109.1
109.1	109.1	109.1	109.1	109.1	109.1	109.1	109.1	109.1	109.1
109.1	109.1	109.1	109.1	109.1	109.1	109.1	109.1	109.1	109.1
109.1	109.2	109.2	109.2	109.2	109.2	109.3	109.3	109.4	109.4
109.5	109.5	109.6	109.7	109.8	109.9	110.0	110.1	110.2	110.3
110.4	110.4	110.5	110.6	110.7	110.8	111.0	111.2	111.3	111.4
111.6	111.7	111.9	112.1	112.4	112.6	112.8	113.0	113.3	113.5
113.8	114.0	114.2	114.5	114.7	114.9	115.2	115.4	115.6	115.8
116.0	116.2	116.4	116.6	116.8	116.9	117.1	117.3	117.4	117.6
117.7	117.9	118.0	118.1	118.3	118.4	118.5	118.7	118.8	118.9
119.1	119.2	119.3	119.4	119.5	119.7	119.8	119.9	120.0	120.1
120.2	120.3	120.4	120.5	120.6	120.6	122.2	120.9	120.6	121.0
120.8	121.0	120.8	121.0	120.8	121.0	120.8	120.9	120.8	120.8

120.7	120.7	120.6	120.5	120.4	120.4	120.2	120.2	120.0	119.9
119.8	119.7	119.5	119.4	119.2	119.1	118.9	118.8	118.6	118.5
116.3	116.2	116.0	117.8	117.7	117.5	117.3	117.1	116.9	116.7
116.5	116.2	116.0	115.7	115.5	115.3	115.1	114.9	114.6	114.4
114.2	114.0	113.8	113.6	113.5	113.3	113.2	113.1	112.9	112.8
112.7	112.6	112.5	112.4	112.3	112.1	112.0	111.9	111.8	111.7
111.6	111.5	111.4	111.3	111.3	111.2	111.1	110.9	110.9	110.8
110.7	110.7	110.6	110.5	110.5	110.5	110.4	110.4	110.3	110.3
110.3	110.2	110.2	110.2	110.2	110.1	110.1	110.1	110.1	110.0
110.0	110.0	109.9	109.9	109.9	109.8	109.8	109.8	109.8	109.8
109.7	109.7	109.7	109.7	109.7	109.6	109.6	109.6	109.6	109.6

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	90240.	73638.	58871.	25134.	5446813.
CMS	2555.	2085.	1667.	712.	154236.
INCHES		1.55	4.97	6.36	6.38
MM		39.46	126.20	161.63	162.16
AC-FT		36515.	116769.	149556.	150050.
THOUS CU M		45040.	144033.	184474.	185084.

MAXIMUM STORAGE = 64.

MAXIMUM STAGE IS 122.2

STATION 56.2, PLAN 3, RTIO 1

OUTFLOW

121.	183.	254.	286.	315.	329.	340.	346.	349.	349.
348.	346.	343.	340.	336.	332.	328.	324.	319.	315.
310.	306.	302.	298.	293.	289.	285.	281.	277.	273.
269.	265.	261.	257.	252.	248.	244.	240.	236.	231.
227.	222.	218.	214.	209.	205.	200.	196.	191.	187.
183.	179.	174.	170.	166.	162.	158.	154.	151.	147.
143.	140.	136.	133.	129.	126.	123.	120.	117.	114.
111.	108.	105.	102.	100.	98.	96.	95.	94.	95.
96.	98.	101.	105.	111.	118.	127.	137.	149.	162.
178.	195.	215.	238.	265.	297.	334.	377.	428.	485.
551.	625.	709.	803.	907.	1022.	1177.	1390.	1601.	1774.
1983.	2185.	2421.	2667.	2948.	3255.	3658.	4070.	4510.	5003.
5561.	6195.	6905.	7691.	8554.	9497.	10581.	11711.	12848.	14070.
15330.	16632.	17950.	19365.	20785.	22187.	23607.	25039.	26457.	27857.
29247.	30657.	32006.	33326.	34626.	35909.	37168.	38414.	39645.	40868.
42086.	43295.	44479.	45643.	46794.	47952.	49120.	50301.	51491.	52693.
53897.	55126.	56386.	57629.	58851.	60081.	61284.	62482.	63644.	64785.
65884.	66944.	67951.	68907.	69795.	70630.	84486.	78988.	71740.	73711.
72944.	74205.	73473.	74308.	73558.	74019.	73219.	73350.	72478.	72325.
71398.	71018.	69977.	69344.	68186.	67343.	66085.	65073.	63734.	62584.
61180.	59928.	58480.	57163.	55727.	54365.	52885.	51489.	50066.	48730.
47292.	45884.	44412.	43022.	41541.	40070.	38543.	37034.	35834.	34385.
32483.	30569.	28851.	27227.	25827.	24457.	22980.	21575.	20112.	18799.
17636.	16600.	15586.	14636.	13814.	13086.	12412.	11780.	11141.	10522.

9976.	9473.	8994.	8533.	8094.	7666.	7194.	6735.	6339.	5967.
5617.	5282.	4966.	4666.	4384.	4121.	3805.	3539.	3335.	3130.
2954.	2782.	2630.	2485.	2355.	2233.	2122.	2019.	1925.	1837.
1757.	1682.	1613.	1549.	1490.	1428.	1348.	1306.	1266.	1221.
1183.	1145.	1110.	1076.	1044.	1013.	984.	956.	929.	903.
878.	854.	831.	808.	786.	765.	745.	725.	706.	687.

STOR

1.	1.	1.	1.	1.	1.	1.	1.	1.	1.
1.	1.	1.	1.	1.	1.	1.	1.	1.	1.
1.	1.	1.	1.	1.	1.	1.	1.	1.	1.
1.	1.	1.	1.	1.	1.	1.	1.	1.	1.
1.	1.	1.	1.	1.	1.	1.	1.	1.	1.
1.	1.	1.	1.	1.	1.	1.	1.	1.	1.
1.	1.	1.	1.	1.	1.	1.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	1.	1.	1.	1.
1.	1.	1.	1.	1.	1.	1.	2.	2.	2.
2.	3.	3.	3.	4.	4.	5.	6.	6.	6.
7.	7.	8.	8.	9.	9.	10.	11.	12.	12.
13.	14.	15.	16.	17.	18.	19.	21.	22.	23.
24.	26.	27.	28.	29.	31.	32.	33.	34.	35.
36.	37.	38.	39.	40.	41.	42.	43.	44.	45.
46.	46.	47.	48.	49.	50.	51.	51.	52.	53.
54.	55.	56.	57.	58.	59.	60.	61.	62.	63.
64.	65.	65.	66.	67.	68.	79.	75.	69.	70.
70.	71.	70.	71.	70.	70.	70.	70.	69.	69.
68.	68.	67.	67.	66.	65.	64.	63.	62.	61.
60.	59.	58.	57.	55.	54.	53.	52.	51.	50.
49.	48.	47.	46.	45.	44.	43.	42.	41.	40.
39.	37.	36.	35.	34.	32.	31.	30.	29.	28.
27.	26.	25.	24.	23.	22.	21.	21.	20.	19.
19.	18.	18.	17.	16.	16.	15.	15.	14.	14.
13.	13.	12.	12.	11.	11.	10.	10.	9.	9.
9.	8.	8.	8.	8.	7.	7.	7.	7.	7.
6.	6.	6.	6.	6.	6.	6.	5.	5.	5.
5.	5.	5.	4.	4.	4.	4.	4.	4.	4.
4.	4.	3.	3.	3.	3.	3.	3.	3.	3.

STAGE

109.1	109.2	109.2	109.2	109.3	109.3	109.3	109.3	109.3	109.3
109.3	109.3	109.3	109.3	109.3	109.3	109.3	109.3	109.3	109.3
109.3	109.3	109.3	109.2	109.2	109.2	109.2	109.2	109.2	109.2
109.2	109.2	109.2	109.2	109.2	109.2	109.2	109.2	109.2	109.2
109.2	109.2	109.2	109.2	109.2	109.2	109.2	109.2	109.2	109.2
109.2	109.1	109.1	109.1	109.1	109.1	109.1	109.1	109.1	109.1
109.1	109.1	109.1	109.1	109.1	109.1	109.1	109.1	109.1	109.1
109.1	109.1	109.1	109.1	109.1	109.1	109.1	109.1	109.1	109.1
109.1	109.1	109.1	109.1	109.1	109.1	109.1	109.1	109.1	109.1
109.1	109.2	109.2	109.2	109.2	109.2	109.3	109.3	109.4	109.4
109.5	109.5	109.6	109.7	109.8	109.9	110.0	110.1	110.2	110.4

110.4	110.4	110.5	110.6	110.7	110.8	111.0	111.2	111.3	111.4
111.6	111.7	111.9	112.1	112.4	112.6	112.8	113.0	113.3	113.5
113.8	114.0	114.2	114.5	114.7	114.9	115.2	115.4	115.6	115.8
116.0	116.2	116.4	116.6	116.8	116.9	117.1	117.3	117.4	117.6
117.7	117.9	118.0	118.1	118.3	118.4	118.5	118.7	118.8	118.9
119.1	119.2	119.3	119.4	119.5	119.7	119.8	119.9	120.0	120.1
120.2	120.3	120.4	120.5	120.6	120.6	121.8	121.3	120.7	120.9
120.8	121.0	120.9	121.0	120.9	120.9	120.9	120.9	120.8	120.8
120.7	120.7	120.6	120.5	120.4	120.4	120.2	120.2	120.0	119.9
119.8	119.7	119.5	119.4	119.2	119.1	119.0	118.8	118.6	118.5
118.3	118.2	118.0	117.8	117.7	117.5	117.3	117.1	116.9	116.7
116.5	116.2	116.0	115.7	115.5	115.3	115.1	114.8	114.6	114.4
114.2	114.0	113.8	113.6	113.5	113.3	113.2	113.1	112.9	112.8
112.7	112.6	112.5	112.4	112.3	112.1	112.0	111.9	111.8	111.7
111.6	111.5	111.4	111.3	111.3	111.2	111.1	110.9	110.9	110.8
110.7	110.7	110.6	110.5	110.5	110.5	110.4	110.4	110.3	110.3
110.3	110.2	110.2	110.2	110.2	110.1	110.1	110.1	110.1	110.0
110.0	110.0	109.9	109.9	109.9	109.8	109.8	109.8	109.8	109.8
109.7	109.7	109.7	109.7	109.7	109.6	109.6	109.6	109.6	109.6

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	84486.	73651.	58875.	25135.	5447066.
CMS	2392.	2086.	1667.	712.	154244.
INCHES		1.55	4.97	6.36	6.38
MM		39.47	126.20	161.64	162.17
AC-FT		36521.	116776.	149563.	150057.
THOUS CU M		45048.	144042.	184483.	185092.

MAXIMUM STORAGE = 79.

MAXIMUM STAGE IS 121.8

********** *********** ********** ********** **********

HYDROGRAPH ROUTING

ROUTE OVER DOWNSTREAM DAM (BY RESARCH LAB)

ISTAQ	ICOPP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
56.3	1	0	0	0	2	1	0	0

ALL PLANS HAVE SAME ROUTING DATA

QLOSS	CLOSS	AVG	IRES	ISAME	IOPT	IPRP	LSTR
0.0	0.000	0.00	1	1	0	0	0

NSTPS	NSTDL	LAG	AMSKK	X	TSK	STORA	ISPRAT
1	0	0	0.000	0.000	0.000	-101.	-1

STAGE	101.00	103.00	105.00	107.00	109.00	111.00	113.00	115.00	117.00
	121.00	123.00	125.00	127.00	129.00	131.00			
FLOW	0.00	2630.00	7870.00	14550.00	22740.00	32445.00	43900.00	56280.00	69140.00
	97940.00	112990.00	126750.00	145170.00	162240.00	179930.00			
CAPACITY=	0.	130.	323.	757.					
ELEVATION=	101.	105.	110.	120.					

CREL	SPWID	COGW	EXPW	ELEVL	COGL	CAREA	EXPL
101.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

DAM DATA

TOPEL	COGD	EXPD	DAMWID
107.0	2.6	1.5	100.

STATION 56.3, PLAN 1, RATIO 1

END-OF-PERIOD HYDROGRAPH ORDINATES

OUTFLOW

87.	133.	194.	248.	286.	312.	328.	339.	345.	348.
346.	347.	345.	343.	339.	336.	332.	327.	323.	319.
314.	310.	306.	301.	297.	293.	289.	285.	281.	277.
272.	268.	264.	260.	256.	252.	248.	244.	239.	235.
231.	226.	222.	217.	213.	209.	204.	200.	195.	191.
187.	182.	178.	174.	170.	166.	162.	158.	154.	150.
146.	143.	139.	136.	132.	129.	126.	122.	119.	116.
113.	110.	108.	105.	102.	100.	98.	96.	95.	95.
95.	96.	98.	102.	106.	112.	120.	129.	139.	151.
165.	180.	198.	218.	242.	270.	303.	341.	385.	436.
495.	562.	637.	723.	818.	923.	1049.	1217.	1416.	1610.
1802.	2004.	2218.	2451.	2742.	3120.	3474.	3884.	4311.	4780.
5308.	5908.	6584.	7336.	8174.	9100.	10121.	11236.	12371.	13554.
14825.	16221.	17526.	18915.	20347.	21759.	23175.	24671.	26094.	27502.
28895.	30246.	31633.	32955.	34264.	35602.	36866.	38116.	39352.	40576.
41796.	43008.	44200.	45368.	46524.	47679.	48867.	50039.	51231.	52429.
53634.	54855.	56110.	57361.	58567.	59813.	61026.	62222.	63409.	64547.
65659.	66726.	67746.	68712.	69616.	70460.	77117.	75829.	70750.	73676.
73192.	73721.	73899.	73877.	73965.	73708.	73589.	73153.	72820.	72223.
71715.	70993.	70295.	69394.	68506.	67455.	66410.	65234.	64063.	62786.
61519.	60171.	58823.	57426.	56060.	54647.	53225.	51761.	50366.	49012.
47626.	46214.	44766.	43342.	41905.	40415.	38915.	37392.	36098.	34764.
33048.	31100.	29325.	27633.	26168.	24811.	23376.	22007.	20563.	19195.
17992.	16922.	15914.	14944.	14126.	13391.	12693.	12048.	11414.	10781.
10204.	9684.	9194.	8726.	8278.	7847.	7408.	6941.	6516.	6134.
5774.	5432.	5108.	4800.	4510.	4239.	3949.	3657.	3425.	3222.
3033.	2859.	2698.	2576.	2464.	2342.	2224.	2114.	2012.	1918.
1832.	1751.	1677.	1609.	1545.	1484.	1415.	1352.	1305.	1261.
1219.	1180.	1142.	1107.	1073.	1041.	1011.	981.	953.	926.

901.	876.	852.	829.	806.	784.	763.	743.	723.	704.
				STORAGE					
2.	3.	5.	6.	7.	8.	8.	8.	9.	9.
9.	9.	9.	8.	8.	8.	8.	8.	8.	8.
8.	8.	8.	7.	7.	7.	7.	7.	7.	7.
7.	7.	7.	6.	6.	6.	6.	6.	6.	6.
6.	6.	5.	5.	5.	5.	5.	5.	5.	5.
5.	5.	4.	4.	4.	4.	4.	4.	4.	4.
4.	4.	3.	3.	3.	3.	3.	3.	3.	3.
3.	3.	3.	3.	3.	2.	2.	2.	2.	2.
2.	2.	2.	3.	3.	3.	3.	3.	3.	4.
4.	4.	5.	5.	6.	7.	7.	8.	10.	11.
12.	14.	16.	18.	20.	23.	26.	30.	35.	40.
45.	50.	55.	61.	66.	71.	75.	81.	86.	92.
98.	106.	114.	123.	134.	144.	156.	169.	182.	196.
210.	222.	234.	246.	258.	270.	282.	293.	303.	313.
323.	333.	344.	354.	364.	373.	382.	390.	398.	406.
414.	422.	430.	438.	445.	453.	460.	467.	474.	481.
489.	496.	503.	511.	518.	526.	533.	540.	547.	553.
560.	566.	572.	577.	582.	587.	625.	618.	569.	605.
603.	606.	607.	606.	607.	606.	605.	602.	600.	597.
594.	590.	586.	581.	576.	570.	564.	557.	551.	543.
536.	528.	520.	511.	503.	495.	486.	477.	469.	461.
452.	443.	434.	424.	415.	405.	395.	385.	377.	368.
355.	340.	326.	314.	303.	294.	283.	272.	260.	248.
238.	229.	220.	211.	202.	194.	186.	178.	171.	164.
157.	151.	145.	140.	135.	130.	124.	118.	113.	108.
104.	100.	96.	92.	88.	85.	81.	78.	75.	72.
70.	68.	66.	64.	61.	58.	55.	52.	50.	47.
45.	43.	41.	40.	38.	37.	35.	33.	32.	31.
30.	29.	28.	27.	27.	26.	25.	24.	24.	23.
22.	22.	21.	20.	20.	19.	19.	18.	18.	17.
				STAGE					
101.1	101.1	101.1	101.2	101.2	101.2	101.2	101.3	101.3	101.3
101.3	101.3	101.3	101.3	101.3	101.3	101.3	101.2	101.2	101.2
101.2	101.2	101.2	101.2	101.2	101.2	101.2	101.2	101.2	101.2
101.2	101.2	101.2	101.2	101.2	101.2	101.2	101.2	101.2	101.2
101.2	101.2	101.2	101.2	101.2	101.2	101.2	101.2	101.1	101.1
101.1	101.1	101.1	101.1	101.1	101.1	101.1	101.1	101.1	101.1
101.1	101.1	101.1	101.1	101.1	101.1	101.1	101.1	101.1	101.1
101.1	101.1	101.1	101.1	101.1	101.1	101.1	101.1	101.1	101.1
101.1	101.1	101.1	101.1	101.1	101.1	101.1	101.1	101.1	101.1
101.1	101.1	101.2	101.2	101.2	101.2	101.2	101.3	101.3	101.3
101.4	101.4	101.5	101.5	101.6	101.7	101.8	101.9	102.1	102.2
102.4	102.5	102.7	102.9	103.0	103.2	103.3	103.5	103.6	103.8
104.0	104.3	104.5	104.8	105.1	105.4	105.7	106.0	106.3	106.7
107.1	107.4	107.7	108.0	108.3	108.6	108.9	109.2	109.5	109.7
110.0	110.2	110.5	110.7	110.9	111.2	111.4	111.5	111.7	111.9
112.1	112.3	112.5	112.6	112.8	113.0	113.2	113.3	113.5	113.6
113.8	114.0	114.2	114.3	114.5	114.7	114.8	115.0	115.2	115.3

115.5	115.6	115.7	115.9	116.0	116.1	117.0	116.8	116.1	116.5
116.4	116.5	116.5	116.5	116.5	116.5	116.5	116.4	116.4	116.3
116.2	116.2	116.1	115.9	115.8	115.7	115.6	115.4	115.2	115.1
114.9	114.7	114.5	114.3	114.2	114.0	113.8	113.6	113.4	113.2
113.0	112.8	112.5	112.3	112.1	111.9	111.7	111.4	111.2	111.0
110.7	110.4	110.1	109.8	109.5	109.2	109.0	108.7	108.4	108.1
107.8	107.6	107.3	107.1	106.9	106.7	106.4	106.3	106.1	105.9
105.7	105.5	105.4	105.3	105.1	105.0	104.8	104.6	104.5	104.3
104.2	104.1	103.9	103.8	103.7	103.6	103.5	103.4	103.3	103.2
103.2	103.1	103.0	103.0	102.9	102.8	102.7	102.6	102.5	102.5
102.4	102.3	102.3	102.2	102.2	102.1	102.1	102.0	102.0	102.0
101.9	101.9	101.9	101.8	101.8	101.8	101.8	101.7	101.7	101.7
101.7	101.7	101.6	101.6	101.6	101.6	101.6	101.6	101.5	101.5

PEAK OUTFLOW IS 77117. AT TIME 59.00 HOURS

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	77117.	73035.	58724.	25082.	5435561.
CMS	2184.	2068.	1663.	710.	153918.
INCHES		1.54	4.96	6.35	6.37
MM		39.14	125.88	161.30	161.83
AC-FT		36216.	116477.	149246.	149740.
THOUS CU M		44672.	143672.	184092.	184701.

STATION 56.3, PLAN 2, RATIO 1

END-OF-PERIOD HYDROGRAPH ORDINATES

OUTFLOW

87.	133.	194.	248.	286.	312.	328.	339.	345.	348.
348.	347.	345.	343.	339.	336.	332.	327.	323.	319.
314.	310.	306.	301.	297.	293.	289.	285.	281.	277.
272.	268.	264.	260.	256.	252.	248.	244.	239.	235.
231.	226.	222.	217.	213.	209.	204.	200.	195.	191.
187.	182.	178.	174.	170.	166.	162.	158.	154.	150.
146.	143.	139.	136.	132.	129.	126.	122.	119.	116.
113.	110.	106.	105.	102.	100.	98.	96.	95.	95.
95.	96.	98.	102.	106.	112.	120.	129.	139.	151.
165.	180.	198.	218.	242.	270.	303.	341.	385.	436.
495.	562.	637.	723.	818.	923.	1049.	1217.	1416.	1610.
1802.	2004.	2218.	2451.	2742.	3120.	3474.	3884.	4311.	4780.
5308.	5908.	6584.	7336.	8174.	9100.	10121.	11236.	12371.	13554.
14825.	16221.	17526.	18915.	20347.	21759.	23175.	24671.	26094.	27502.
28895.	30246.	31633.	32955.	34264.	35602.	36866.	38116.	39352.	40576.
41796.	43008.	44200.	45368.	46524.	47679.	48867.	50039.	51231.	52429.
53634.	54855.	56110.	57361.	58587.	59813.	61026.	62222.	63409.	64547.
65659.	66726.	67746.	68712.	69616.	70460.	84812.	80488.	68454.	74549.
72911.	73767.	73943.	73804.	74044.	73632.	73659.	73089.	72877.	72173.
71760.	70954.	70330.	69363.	68534.	67431.	66431.	65215.	64079.	62771.
61532.	60160.	58833.	57417.	56067.	54641.	53231.	51775.	50391.	49008.

[illegible]	46211.	[illegible]	43340.	41907.	40414.	38916.	37391.	36100.	34763.
33047.	31099.	29326.	27633.	26169.	24811.	23376.	22006.	20563.	19194.
17992.	16921.	15914.	14944.	14126.	13391.	12693.	12048.	11414.	10781.
10204.	9684.	9194.	8726.	8278.	7847.	7408.	6941.	6516.	6134.
5774.	5432.	5106.	4800.	4510.	4239.	3949.	3657.	3425.	3222.
3033.	2859.	2696.	2576.	2464.	2342.	2224.	2114.	2012.	1918.
1832.	1751.	1677.	1609.	1545.	1484.	1415.	1352.	1305.	1261.
1219.	1180.	1142.	1107.	1073.	1041.	1011.	981.	953.	926.
901.	876.	852.	829.	806.	784.	763.	743.	723.	704.

STORAGE

2.	3.	5.	6.	7.	8.	8.	8.	9.	9.
9.	9.	9.	8.	8.	8.	8.	8.	8.	8.
8.	8.	8.	7.	7.	7.	7.	7.	7.	7.
7.	7.	7.	6.	6.	6.	6.	6.	6.	6.
6.	6.	5.	5.	5.	5.	5.	5.	5.	5.
5.	5.	4.	4.	4.	4.	4.	4.	4.	4.
4.	4.	3.	3.	3.	3.	3.	3.	3.	3.
3.	3.	3.	3.	3.	2.	2.	2.	2.	2.
2.	2.	2.	3.	3.	3.	3.	3.	3.	4.
4.	4.	5.	5.	6.	7.	7.	8.	10.	11.
12.	14.	16.	18.	20.	23.	26.	30.	35.	40.
45.	50.	55.	61.	66.	71.	75.	81.	86.	92.
98.	106.	114.	123.	134.	144.	156.	169.	182.	196.
210.	222.	234.	246.	258.	270.	282.	293.	303.	313.
323.	333.	344.	354.	364.	373.	382.	390.	398.	406.
414.	422.	430.	438.	445.	453.	460.	467.	474.	481.
489.	496.	503.	511.	518.	526.	533.	540.	547.	553.
560.	566.	572.	577.	582.	587.	664.	642.	576.	610.
601.	606.	607.	606.	607.	605.	605.	602.	601.	597.
594.	590.	586.	581.	576.	570.	564.	557.	551.	543.
536.	528.	520.	511.	503.	495.	486.	477.	469.	461.
452.	443.	434.	424.	415.	405.	395.	385.	377.	368.
355.	340.	326.	314.	303.	294.	283.	272.	260.	248.
236.	229.	220.	211.	202.	194.	186.	178.	171.	164.
157.	151.	145.	140.	135.	130.	124.	118.	113.	108.
104.	100.	96.	92.	88.	85.	81.	78.	75.	72.
70.	68.	66.	64.	61.	58.	55.	52.	50.	47.
45.	43.	41.	40.	38.	37.	35.	33.	32.	31.
30.	29.	28.	27.	27.	26.	25.	24.	24.	23.
22.	22.	21.	20.	20.	19.	19.	18.	18.	17.

STAGE

101.1	101.1	101.1	101.2	101.2	101.2	101.2	101.3	101.3	101.3
101.3	101.3	101.3	101.3	101.3	101.3	101.3	101.2	101.2	101.2
101.2	101.2	101.2	101.2	101.2	101.2	101.2	101.2	101.2	101.2
101.2	101.2	101.2	101.2	101.2	101.2	101.2	101.2	101.2	101.2
101.2	101.2	101.2	101.2	101.2	101.2	101.2	101.2	101.1	101.1
101.1	101.1	101.1	101.1	101.1	101.1	101.1	101.1	101.1	101.1
101.1	101.1	101.1	101.1	101.1	101.1	101.1	101.1	101.1	101.1
101.1	101.1	101.1	101.1	101.1	101.1	101.1	101.1	101.1	101.1

101.1	101.1	101.1	101.1	101.1	101.1	101.1	101.1	101.1	101.1
101.1	101.1	101.2	101.2	101.2	101.2	101.2	101.3	101.3	101.3
101.4	101.4	101.5	101.5	101.6	101.7	101.8	101.9	102.1	102.2
102.4	102.5	102.7	102.9	103.0	103.2	103.3	103.5	103.6	103.8
104.0	104.3	104.5	104.8	105.1	105.4	105.7	106.0	106.3	106.7
107.1	107.4	107.7	108.0	108.3	108.6	108.9	109.2	109.5	109.7
110.0	110.2	110.5	110.7	110.9	111.2	111.4	111.5	111.7	111.9
112.1	112.3	112.5	112.6	112.8	113.0	113.2	113.3	113.5	113.6
113.8	114.0	114.2	114.3	114.5	114.7	114.8	115.0	115.2	115.3
115.5	115.6	115.7	115.9	116.0	116.1	117.9	117.4	115.8	116.6
116.4	116.5	116.5	116.5	116.6	116.5	116.5	116.4	116.4	116.3
116.3	116.1	116.1	115.9	115.8	115.7	115.6	115.4	115.2	115.1
114.9	114.7	114.5	114.3	114.2	114.0	113.8	113.6	113.4	113.2
113.0	112.8	112.5	112.3	112.1	111.9	111.7	111.4	111.2	111.0
110.7	110.4	110.1	109.8	109.5	109.2	109.0	108.7	108.4	108.1
107.8	107.6	107.3	107.1	106.9	106.7	106.4	106.3	106.1	105.9
105.7	105.5	105.4	105.3	105.1	105.0	104.8	104.6	104.5	104.3
104.2	104.1	103.9	103.8	103.7	103.6	103.5	103.4	103.3	103.2
103.2	103.1	103.0	103.0	102.9	102.8	102.7	102.6	102.5	102.5
102.4	102.3	102.3	102.2	102.2	102.1	102.1	102.0	102.0	102.0
101.9	101.9	101.9	101.8	101.8	101.8	101.8	101.7	101.7	101.7
101.7	101.7	101.6	101.6	101.6	101.6	101.6	101.6	101.5	101.5

PEAK OUTFLOW IS 84812. AT TIME 59.00 HOURS

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	84812.	73630.	58872.	25131.	5446261.
CMS	2402.	2085.	1667.	712.	154221.
INCHES		1.55	4.97	6.36	6.38
MM		39.46	126.20	161.61	162.15
AC-FT		36511.	116772.	149541.	150035.
THOUS CU M		45035.	144036.	184456.	185065.

STATION 56.3, PLAN 3, RATIO 1

END-OF-PERIOD HYDROGRAPH ORDINATES

OUTFLOW

87.	133.	194.	248.	286.	312.	328.	339.	345.	348.
348.	347.	345.	343.	339.	336.	332.	327.	323.	319.
314.	310.	306.	301.	297.	293.	289.	285.	281.	277.
272.	268.	264.	260.	256.	252.	248.	244.	239.	235.
231.	226.	222.	217.	213.	209.	204.	200.	195.	191.
187.	182.	178.	174.	170.	166.	162.	158.	154.	150.
146.	143.	139.	136.	132.	129.	126.	122.	119.	116.
113.	110.	108.	105.	102.	100.	98.	96.	95.	95.
95.	96.	98.	102.	106.	112.	120.	129.	139.	151.
165.	180.	198.	218.	242.	270.	303.	341.	385.	436.
495.	562.	637.	723.	818.	923.	1049.	1217.	1416.	1610.
1802.	2004.	2218.	2451.	2742.	3120.	3474.	3884.	4311.	4780.
5306.	5908.	6584.	7336.	8174.	9100.	10121.	11236.	12371.	13554.

14625.	16221.	17526.	18415.	20347.	21759.	23175.	24671.	26094.	27502.
28895.	30246.	31633.	32955.	34264.	35602.	36866.	38116.	39352.	40576.
41796.	43008.	44200.	45368.	46524.	47679.	48867.	50039.	51231.	52429.
53634.	54855.	56110.	57361.	58587.	59813.	61026.	62222.	63409.	64547.
65659.	66726.	67746.	68712.	69616.	70460.	80608.	82257.	72348.	72882.
73512.	73600.	73938.	73871.	73959.	73718.	73578.	73163.	72811.	72232.
71708.	71000.	70289.	69400.	68501.	67459.	66406.	65238.	64060.	62788.
61517.	60173.	58821.	57427.	56058.	54649.	53224.	51781.	50386.	49013.
47625.	46215.	44765.	43342.	41905.	40416.	38914.	37392.	36098.	34765.
33048.	31100.	29325.	27633.	26168.	24812.	23376.	22007.	20563.	19195.
17992.	16922.	15913.	14944.	14126.	13391.	12693.	12048.	11414.	10781.
10204.	9684.	9194.	8726.	8278.	7847.	7408.	6941.	6516.	6134.
5774.	5432.	5106.	4800.	4510.	4239.	3949.	3657.	3425.	3222.
3033.	2859.	2698.	2576.	2464.	2342.	2224.	2114.	2012.	1918.
1832.	1751.	1677.	1609.	1545.	1484.	1415.	1352.	1305.	1261.
1219.	1180.	1142.	1107.	1073.	1041.	1011.	981.	953.	926.
901.	876.	852.	829.	806.	784.	763.	743.	723.	704.

STORAGE

2.	3.	5.	6.	7.	8.	8.	8.	9.	9.
9.	9.	9.	8.	8.	8.	8.	8.	8.	8.
8.	8.	8.	7.	7.	7.	7.	7.	7.	7.
7.	7.	7.	6.	6.	6.	6.	6.	6.	6.
6.	6.	5.	5.	5.	5.	5.	5.	5.	5.
5.	5.	4.	4.	4.	4.	4.	4.	4.	4.
4.	4.	3.	3.	3.	3.	3.	3.	3.	3.
3.	3.	3.	3.	3.	2.	2.	2.	2.	2.
2.	2.	2.	3.	3.	3.	3.	3.	3.	4.
4.	4.	5.	5.	6.	7.	7.	8.	10.	11.
12.	14.	16.	18.	20.	23.	26.	30.	35.	40.
45.	50.	55.	61.	66.	71.	75.	81.	86.	92.
98.	106.	114.	123.	134.	144.	156.	169.	182.	196.
210.	222.	234.	246.	258.	270.	282.	293.	303.	313.
323.	333.	344.	354.	364.	373.	382.	390.	398.	406.
414.	422.	430.	438.	445.	453.	460.	467.	474.	481.
489.	496.	503.	511.	518.	526.	533.	540.	547.	553.
560.	566.	572.	577.	582.	587.	643.	651.	598.	601.
604.	605.	607.	606.	607.	606.	605.	602.	600.	597.
594.	590.	586.	581.	576.	570.	564.	557.	550.	543.
536.	528.	520.	511.	503.	495.	486.	477.	469.	461.
452.	443.	434.	424.	415.	405.	395.	385.	377.	368.
355.	340.	326.	314.	303.	294.	283.	272.	260.	248.
236.	229.	220.	211.	202.	194.	186.	178.	171.	164.
157.	151.	145.	140.	135.	130.	124.	118.	113.	108.
104.	100.	96.	92.	88.	85.	81.	78.	75.	72.
70.	68.	66.	64.	61.	58.	55.	52.	50.	47.
45.	43.	41.	40.	38.	37.	35.	33.	32.	31.
30.	29.	28.	27.	27.	26.	25.	24.	24.	23.
22.	22.	21.	20.	20.	19.	19.	18.	18.	17.

STAGE

101.1	101.1	101.1	101.2	101.2	101.2	101.2	101.3	101.3	101.3
101.3	101.3	101.3	101.3	101.3	101.3	101.3	101.2	101.2	101.2
101.2	101.2	101.2	101.2	101.2	101.2	101.2	101.2	101.2	101.2
101.2	101.2	101.2	101.2	101.2	101.2	101.2	101.2	101.2	101.2
101.2	101.2	101.2	101.2	101.2	101.2	101.2	101.2	101.1	101.1
101.1	101.1	101.1	101.1	101.1	101.1	101.1	101.1	101.1	101.1
101.1	101.1	101.1	101.1	101.1	101.1	101.1	101.1	101.1	101.1
101.1	101.1	101.1	101.1	101.1	101.1	101.1	101.1	101.1	101.1
101.1	101.1	101.1	101.1	101.1	101.1	101.1	101.1	101.1	101.1
101.1	101.1	101.2	101.2	101.2	101.2	101.2	101.3	101.3	101.3
101.4	101.4	101.5	101.5	101.6	101.7	101.8	101.9	102.1	102.2
102.4	102.5	102.7	102.9	103.0	103.2	103.3	103.5	103.6	103.8
104.0	104.3	104.5	104.8	105.1	105.4	105.7	106.0	106.3	106.7
107.1	107.4	107.7	108.0	108.3	108.6	108.9	109.2	109.5	109.7
110.0	110.2	110.5	110.7	110.9	111.2	111.4	111.5	111.7	111.9
112.1	112.3	112.5	112.6	112.8	113.0	113.2	113.3	113.5	113.6
113.8	114.0	114.2	114.3	114.5	114.7	114.8	115.0	115.2	115.3
115.5	115.6	115.7	115.9	116.0	116.1	117.4	117.6	116.3	116.4
116.5	116.5	116.5	116.5	116.5	116.5	116.5	116.4	116.4	116.3
116.2	116.2	116.1	115.9	115.8	115.7	115.6	115.4	115.2	115.1
114.9	114.7	114.5	114.3	114.2	114.0	113.8	113.6	113.4	113.2
113.0	112.8	112.5	112.3	112.1	111.9	111.7	111.4	111.2	111.0
110.7	110.4	110.1	109.8	109.5	109.2	109.0	108.7	108.4	108.1
107.8	107.6	107.3	107.1	106.9	106.7	106.4	106.3	106.1	105.9
105.7	105.5	105.4	105.3	105.1	105.0	104.8	104.6	104.5	104.3
104.2	104.1	103.9	103.8	103.7	103.6	103.5	103.4	103.3	103.2
103.2	103.1	103.0	103.0	102.9	102.8	102.7	102.6	102.5	102.5
102.4	102.3	102.3	102.2	102.2	102.1	102.1	102.0	102.0	102.0
101.9	101.9	101.9	101.8	101.8	101.8	101.8	101.7	101.7	101.7
101.7	101.7	101.6	101.6	101.6	101.6	101.6	101.6	101.5	101.5

PEAK OUTFLOW IS 82257. AT TIME 59.33 HOURS

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	82257.	73644.	58876.	25132.	5446517.
CMS	2329.	2085.	1667.	712.	154228.
INCHES		1.55	4.97	6.36	6.38
MM		39.47	126.21	161.62	162.16
AC-FT		36518.	116779.	149548.	150042.
THOUS CU M		45044.	144044.	184464.	185074.

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PEAK FLOW AND STORAGE (END OF PERIOD) SUMMARY FOR MULTIPLE PLAN-RATIO ECONOMIC COMPUTATIONS

FLOWS IN CUBIC FEET PER SECOND (CUBIC METERS PER SECOND)
AREA IN SQUARE MILES (SQUARE KILOMETERS)

OPERATION	STATION	AREA	PLAN	RATIO 1
				0.50
HYDROGRAPH AT	54	152.00	1	37871.
		(393.68)		(1072.39)(
			2	37871.
				(1072.39)(
			3	37871.
				(1072.39)(
ROUTED TO	5455	152.00	1	35755.
		(393.68)		(1012.46)(
			2	35755.
				(1012.46)(
			3	35755.
				(1012.46)(
HYDROGRAPH AT	55	242.00	1	40795.
		(626.77)		(1155.19)(
			2	40795.
				(1155.19)(
			3	40795.
				(1155.19)(
2 COMBINED	55	394.00	1	72611.
		(1020.45)		(2056.11)(
			2	72611.
				(2056.11)(
			3	72611.
				(2056.11)(
ROUTED TO	5556	394.00	1	70943.
		(1020.45)		(2008.87)(
			2	70943.
				(2008.87)(
			3	70943.
				(2008.87)(
HYDROGRAPH AT	56.1	46.90	1	14059.
		(121.47)		(398.10)(
			2	14059.
				(398.10)(
			3	14059.

RATIOS APPLIED TO FLOWS

			(396.10)(
2 COMBINED	56.1	440.90	1 73939.
		(1141.92)	(2093.71)(
			2 73939.
			(2093.71)(
			3 73939.
			(2093.71)(
ROUTED TO	56.1	440.90	1 80213.
		(1141.92)	(2271.39)(
			2 91400.
			(2588.17)(
			3 85299.
			(2415.40)(
ROUTED TO	56.2	440.90	1 79689.
		(1141.92)	(2256.54)(
			2 90240.
			(2555.31)(
			3 84486.
			(2392.37)(
ROUTED TO	56.3	440.90	1 77117.
		(1141.92)	(2183.72)(
			2 84812.
			(2401.60)(
			3 82257.
			(2329.25)(

SUMMARY OF DAM SAFETY ANALYSIS

PLAN 1 .....

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	134.00	134.00	141.00
STORAGE	874.	874.	1498.
OUTFLOW	0.	0.	23350.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
0.50	148.07	7.07	2288.	112286.	20.67	58.77	58.67

PLAN 2 .....

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	134.00	134.00	141.00
STORAGE	874.	874.	1498.
OUTFLOW	0.	0.	23350.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
0.50	148.07	7.07	2288.	96149.	20.67	58.96	58.67

PLAN 3 .....

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	134.00	134.00	141.00
STORAGE	874.	874.	1498.
OUTFLOW	0.	0.	23350.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
0.50	148.07	7.07	2288.	88777.	20.67	59.16	58.67

PLAN 1 STATION 56.2

RATIO	MAXIMUM FLOW,CFS	MAXIMUM STAGE,FT	TIME HOURS
0.50	79689.	121.4	59.00

PLAN 2 STATION 56.2

RATIO	MAXIMUM FLOW,CFS	MAXIMUM STAGE,FT	TIME HOURS
0.50	90240.	122.2	59.00

PLAN 3 STATION 56.2

RATIO	MAXIMUM FLOW,CFS	MAXIMUM STAGE,FT	TIME HOURS
0.50	84486.	121.8	59.00

SUMMARY OF DAM SAFETY ANALYSIS

PLAN 1 .....

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	101.00	101.00	107.00
STORAGE	0.	0.	207.
OUTFLOW	0.	0.	14550.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
0.50	116.95	9.95	625.	77117.	34.67	59.00	0.00

PLAN 2 .....

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	101.00	101.00	107.00
STORAGE	0.	0.	207.
OUTFLOW	0.	0.	14550.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
0.50	117.86	10.86	664.	84812.	34.67	59.00	0.00

PLAN 3 .....

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	101.00	101.00	107.00
STORAGE	0.	0.	207.
OUTFLOW	0.	0.	14550.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
0.50	117.56	10.56	651.	82257.	34.67	59.33	0.00

APPENDIX D

STABILITY ANALYSIS

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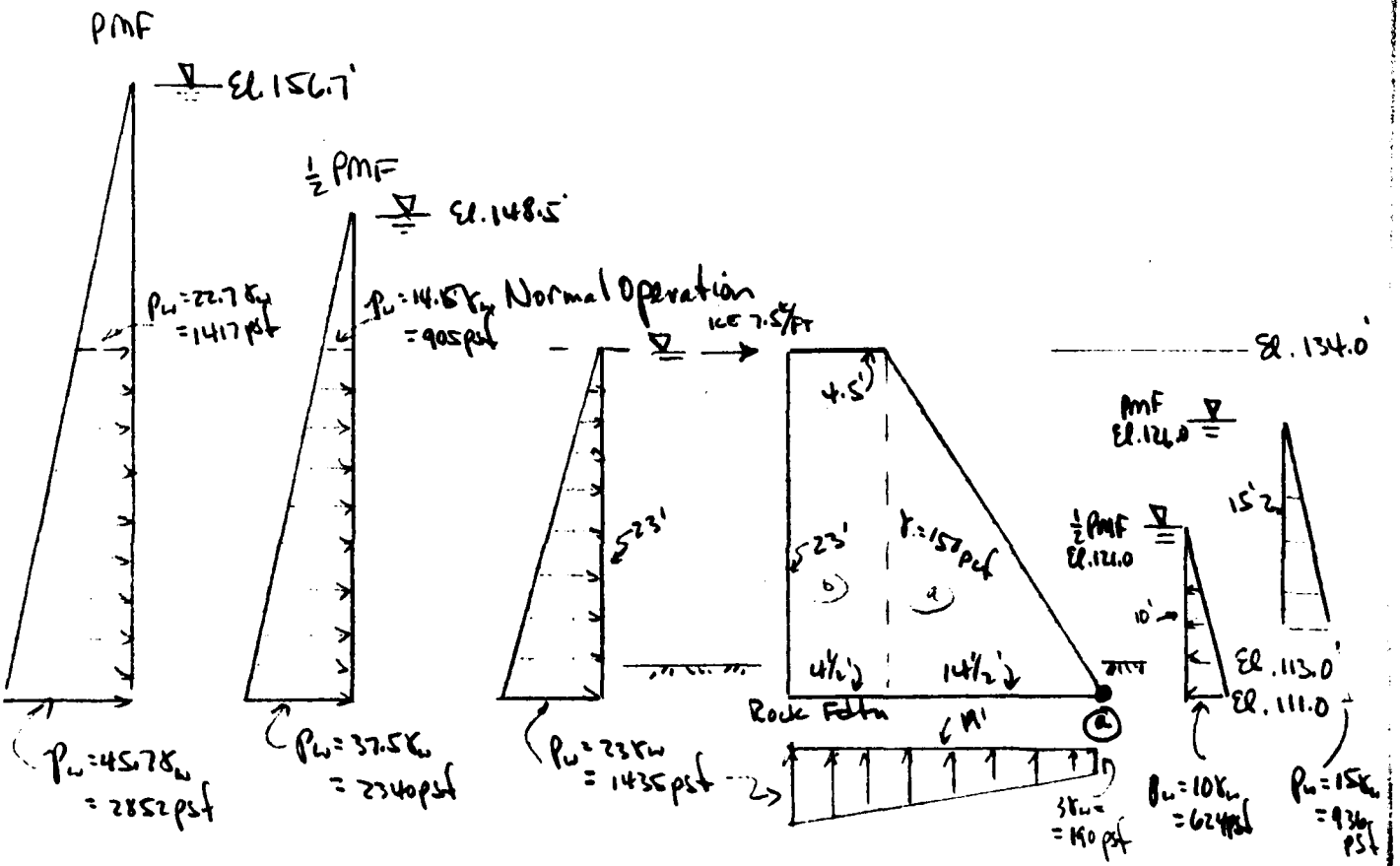
DESIGN BRIEF

PROJECT NAME CLARKS MILLS DAM DATE 5/31/80

SUBJECT STABILITY ANALYSIS PROJECT NO.

DRAWN BY DFM

Assumed Dam Section and Loading Conditions



Wt. of Dam Section = $\left(\frac{1}{2} \times \underset{25}{23} \times 14.5 \times .15\right) + \left(\underset{15.5}{23} \times 4.5 \times .15\right)$ = 40.6 k

M_a due to weight of dam = $\left(\frac{1}{2} \times 15.5 \times 23 \times 14.5 \left(\frac{2 \times 14.5}{3}\right)\right) + \left(23 \times 4.5 \times .15 \left(\frac{4.5}{2} + 14.5\right)\right)$

= 242 + 260 = 502 'k

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PROJECT NAME CLARKS MILLS DATE

SUBJECT PROJECT NO.

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Case I · WL @ Spillway Elevation, No Ice

Overturning

M_a causing overturning due to lateral H_2O pressure, uplift

$$= \left(1.435 \times \frac{23}{2} \times \frac{23}{3}\right) + \left(.190 \times 19 \times \frac{19}{2}\right) + \left(1.435 - .190\right)\left(\frac{19}{2}\right)\left(\frac{2 \times 19}{3}\right) = 311^{k}$$

M_a resisting overturning due to mass of dam, upstream lateral H_2O

$$= 502^{k}$$

FS against overturning $= \dfrac{502^{k}}{311^{k}} = 1.62$

Position of Resultant, R: $d = \dfrac{\Sigma M_a}{\Sigma V}$

$$d = \frac{(502 - 311)}{40.6^{k} - \left(\frac{1.435 + .190}{2}\right)(19')} = \frac{191^{k}}{25.2^{k}} = 7.6' = 0.40\,b$$

Sliding (friction - shear method, $\mu = 0.65$, bond = 50 psi)

$$FS = \frac{\mu V + (\text{bond} \times \text{foundation area})}{\text{forces causing sliding}}$$

$$FS = \frac{(0.65)(25.2^{k}) + (.050 \times 19' \times 144\ \frac{in^2}{ft^2})}{\left(\frac{1}{2} \times 23 \times 1.435\right)} = \frac{15.3^{k}}{16.5^{k}} = 9 \pm$$

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3/

PROJECT NAME CLARKS MILLS DATE

OBJECT PROJECT NO.

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Case II: WL @ Spillway, Ice Load Acting

Overturning

M_a due to upstream H_2O, uplift, ice load

$= 311^k + (7.5^k/ft \times 22') = 476^{ik}$

FS against overturning $= \frac{502^{ik}}{476^{ik}} = \underline{1.05}$

Position of Resultant, R: $d = \frac{\Sigma M_a}{\Sigma V}$

$d = \frac{502 - 476}{25.2^k} = \frac{26}{25.2} = 1.03' = \underline{.056}$

Sliding

FS against sliding $= \frac{153^k}{16.5 + 7.5} = \frac{153^k}{24^k} = \underline{6+}$

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PROJECT NAME CLARKS MILLS DATE

SUBJECT PROJECT NO

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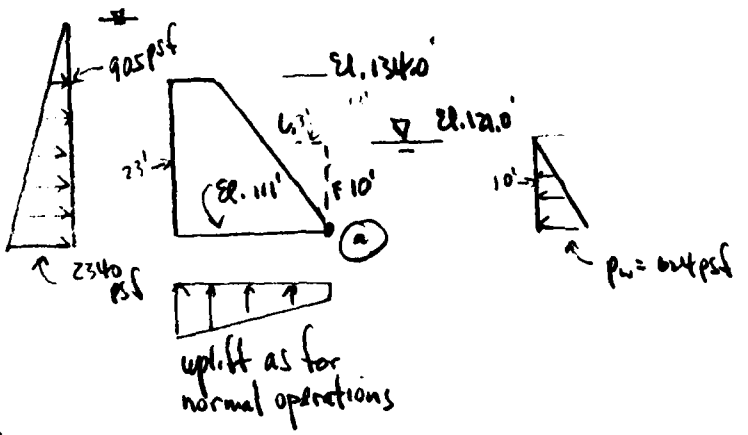
Case III. WL @ ½ PMF Levels



overturning

M_a causing overturning due to upstream H_2O, uplift

$$= \left(.905 \times 23 \times \frac{23}{2}\right) + 311^{k} = 550.1^{k}$$

M_a resisting overturning due to mass of dam, downstream H_2O lateral and vertical

$$I = 502^{k} + \left(.624 \times \frac{10}{2} \times \frac{10}{3}\right) + \left(6.3 \times \frac{10}{2} \times \frac{6.3}{3} \times .0624\right) = 517.5^{k}$$

FS against overturning $= \frac{517.5}{550.1} = \underline{0.94}$ (unsafe)

Position of Resultant, R, outside of base since FS < 1

Sliding

FS against sliding $= \dfrac{\mu V + \text{bond}}{\text{lat. } H_2O \text{ pressure}}$

$$\text{FS} = \frac{(0.65)\left[40.6 - 151^{k} + \left(\frac{6.3 \times 10}{2}\right)(.0624)\right] + 137}{\frac{1}{2}(.905 + 2.340)(23)} = \frac{127 + 137}{37.3} = \underline{4.4}$$

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PROJECT NAME CLARKS MILLS DATE

SUBJECT PROJECT NO

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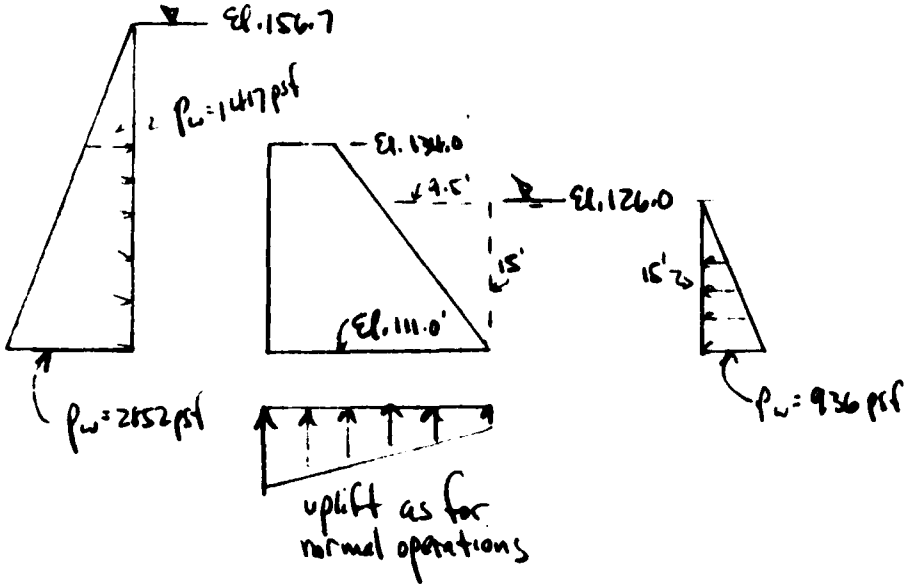
Case II · WL @ PMF Levels



Overturning

M_a causing overturning due to lateral H_2O upstream, uplift

$= \left(1.417 \times 23 \times \frac{23}{2}\right) + 311 = 685.8^{1K}$

M_a resisting overturning due to mass of dam, H_2O downstream lateral and vertical

$= 502^{1K} + \left(.936 \times \frac{15}{2} \times \frac{15}{3}\right) + \left(85 \times 15 \times \frac{1}{2} \times .062\text{k} \times \frac{9.5}{3}\right) = 551^{1K}$

FS against overturning $= \frac{551}{686} = \underline{0.80}$

Position of Resultant, R outside of base since FS < 1

Sliding

$FS = \frac{uV + \text{bond}}{\text{lat } H_2O \text{ upstream}} = \frac{(0.65)\left[406 - 15.4 + \left(.062\text{k} \times 15 \times \frac{9.5}{2}\right)\right] + 137}{\frac{1}{2}\left(1.417 + 2.852\right)(23)} = \frac{156.3}{49.1} = \underline{3.2}$

PROJECT NAME CLARKS MILLS DATE

SUBJECT PROJECT NO.

DRAWN BY

Case II. Normal Operating Condition (WL @ Spillway) Plus Zone 2 Seismic

Additional M_a due to inertial offects on dam, impounded water

dam, vertical, $+M_a$ causing overturning = $.025\ (502^{k}) = 12.6^{k}$

horiz., $+M_a = \left[\left(\frac{1}{2} \times 23 \times 14.5 \times .15\right)\left(\frac{23}{3}\right) + \left(4.5 \times 23 \times .15 \times \frac{23}{2}\right)\right](.05) = 18.5^{k}$

inertial offect on impounded water

$$+M_a = (.73 \times .05 \times .062 \times 23)(.30)(23 \times 23) = 8.3^{k}$$

Total additional M_a due to Seismic = $12.6 + 18.5 + 8.3 = 39.4^{k}$

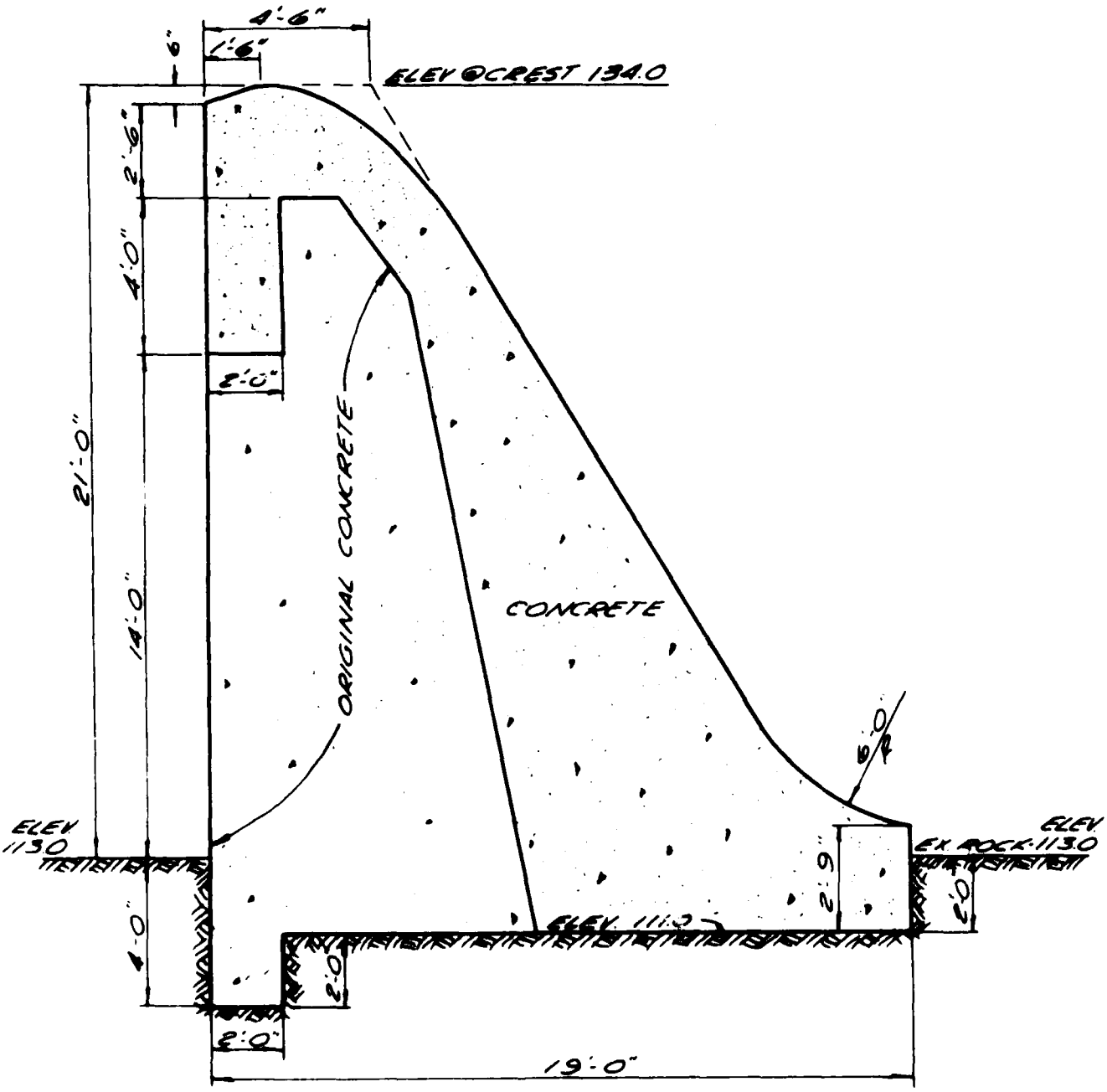
FS against overturning = $\dfrac{502^{k}}{(311 + 39.4)} = 1.43$

Position of Resultant R : $d = \dfrac{\Sigma M_a}{\Sigma V}$

$$d = \frac{(502 - 350.4)}{25.2 - (.025)(40.6)} = 6.26' = 0.33\,b$$

FS against sliding = $\dfrac{(0.65 \times 24.2) + 137}{16.5 + (.73 \times .05 \times .062 \times 23)(.73 \times 23)} = \dfrac{15.7 + 137}{17.4} = 8.8$

inertial effect of upst H$_2$O



CLARKS MILLS DAM
NY120

1/4" = 1'-0"

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DATE 5-1-80	DRAWN OME	TYPICAL SECTION
JOB 2999	CHKD	

APPENDIX E

REFERENCES

APPENDIX

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